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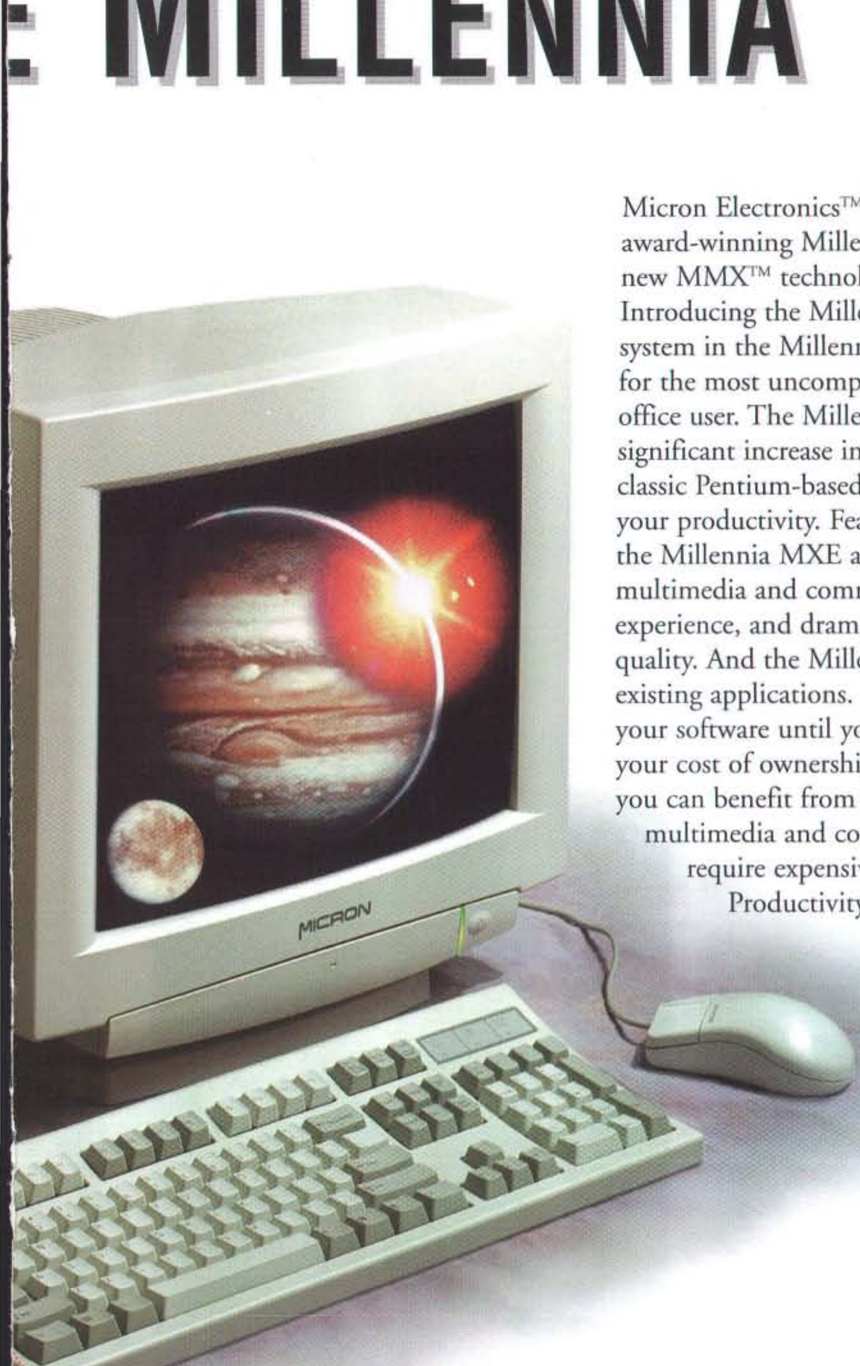

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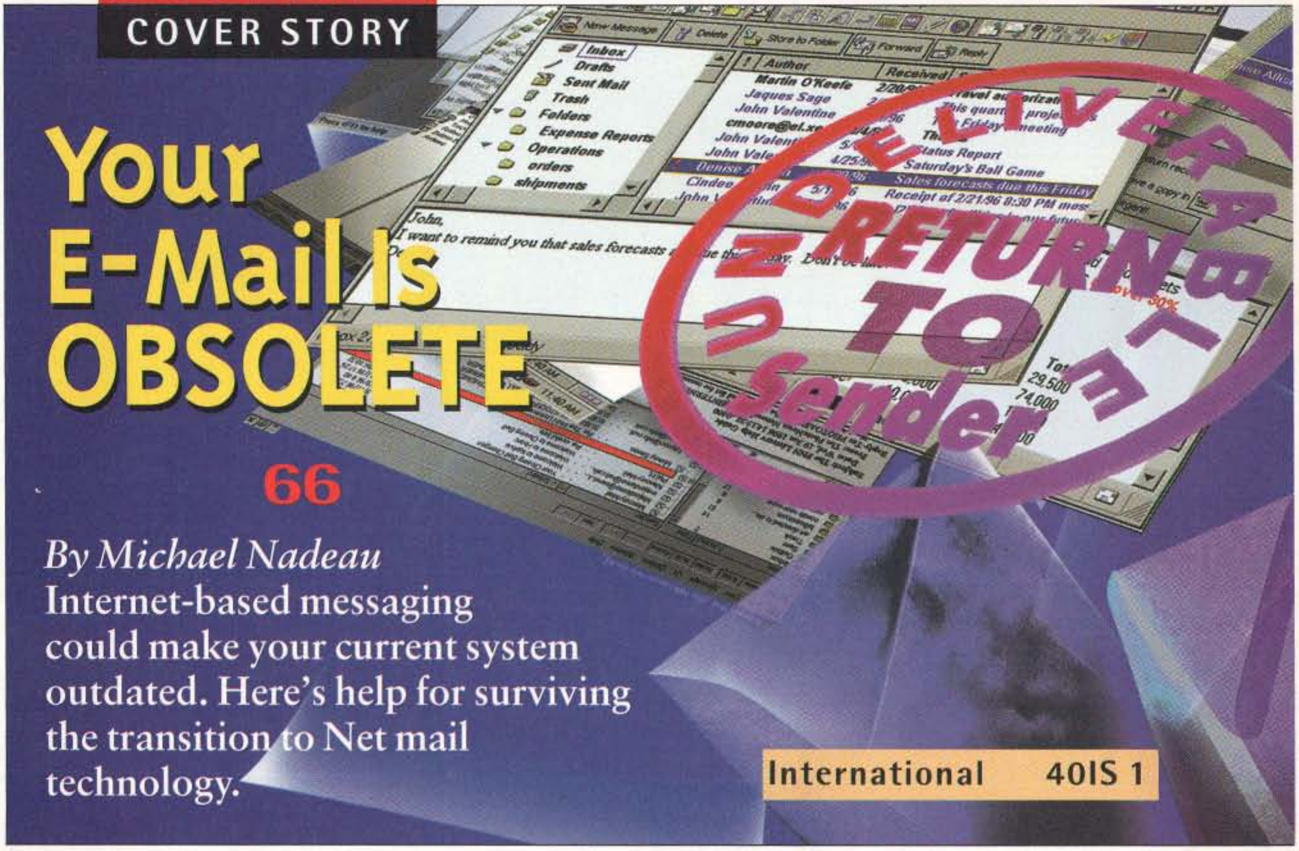

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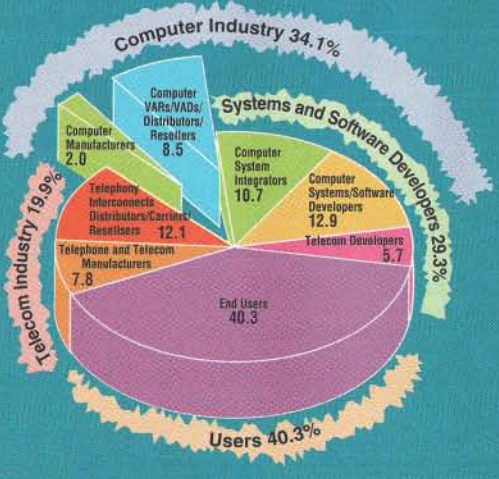

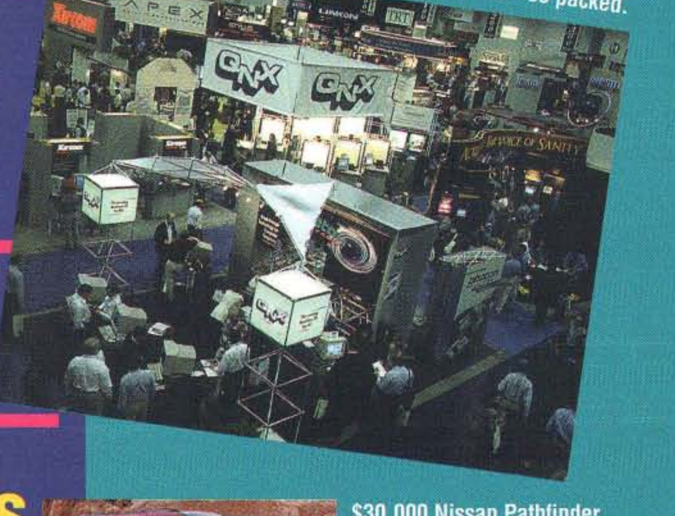
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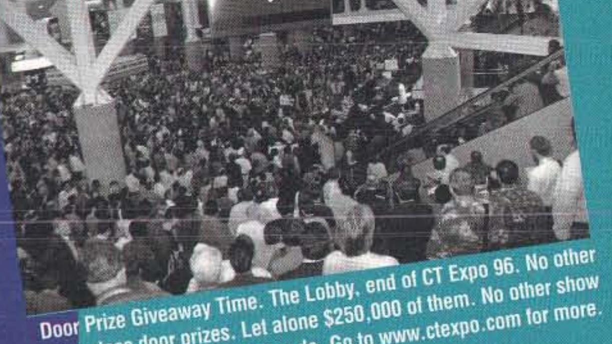

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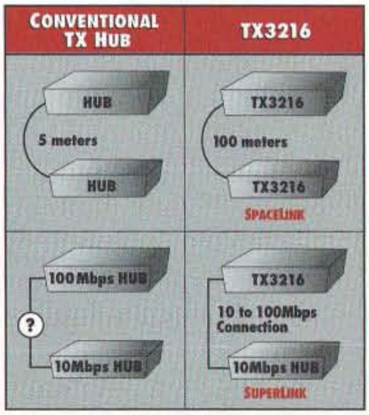

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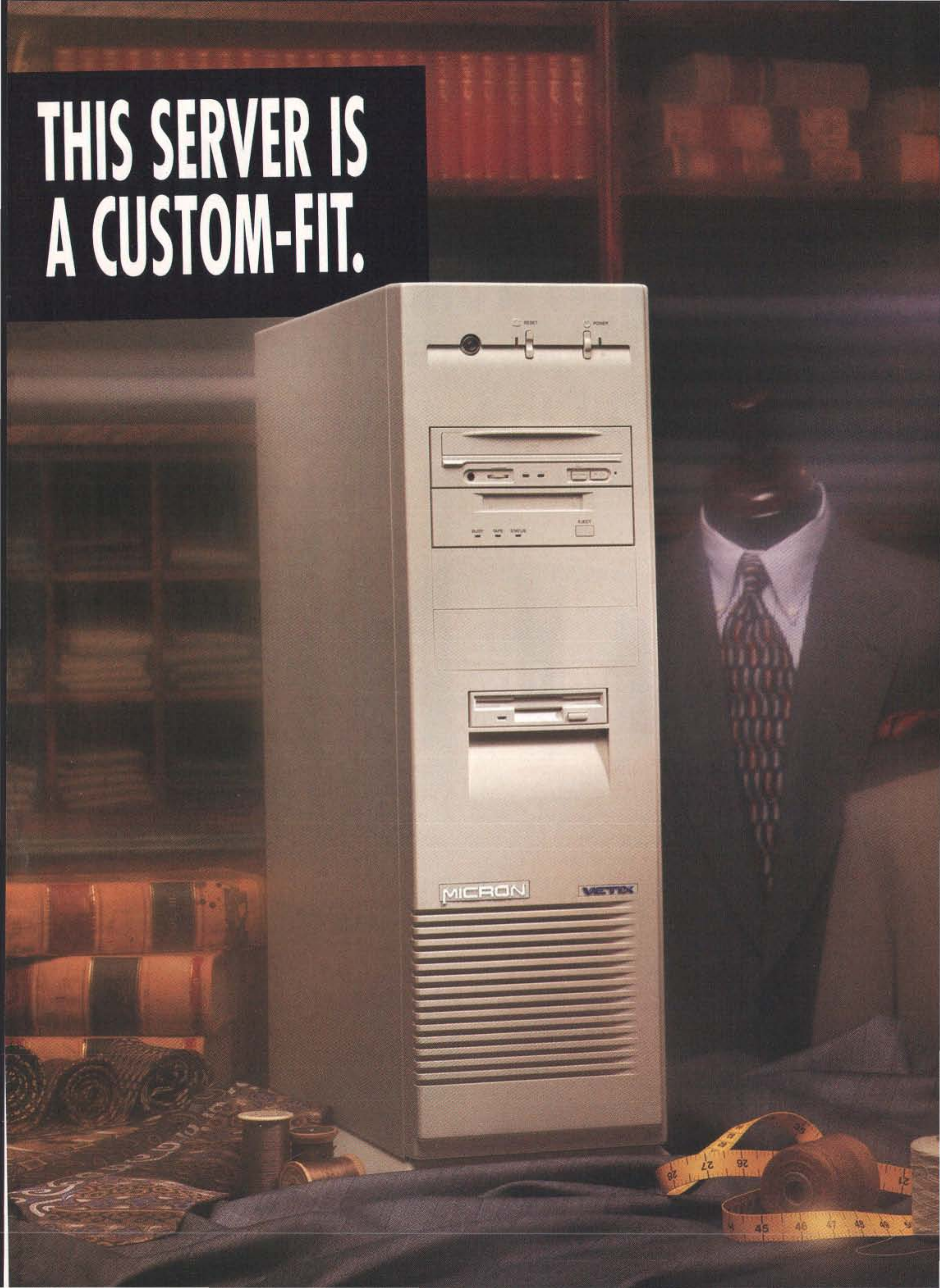
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editorial

Cadillacs or Cherokees?

In our quest to be current, let's not confuse newness with appropriateness.

Fall Comdex produced a definite feeling of split personality in me, and I bet I wasn't the only one. How could BYTE give Office 97 the Best of Comdex award *and* suggest that developers will soon be writing to the Java virtual machine instead of the very same Windows APIs on which Office is built?

Let's start with the fact that personal computers—both PCs and Macs—were never optimized for simple tasks. In the early days, these machines came into companies on the expense accounts of number crunchers, sales presenters, and others whose computing needs were unpredictable, occasionally intensive, and highly individual.

For that reason, today's applications are overkill for many people. And even though it probably won't, Microsoft should rearchitect its massive products the way Corel is building its Java-suite successor to WordPerfect: as a collection of applets that you instantiate as needed. Why complicate your computer?

Still, let's not throw out the baby with the bathwater. Millions of office workers (me, for one) actually do need the complexity that a suite such as Office provides. It was just as evident at Comdex that high-powered, specialized peripherals and applications can transform the general-purpose PC or Mac into an incredibly powerful and inexpensive productivity tool for graphic artists, engineers, multimedia developers, scientists, and a lot of other specialized users. Heck, for $10,000, you can turn your PC into a broadcast TV studio.

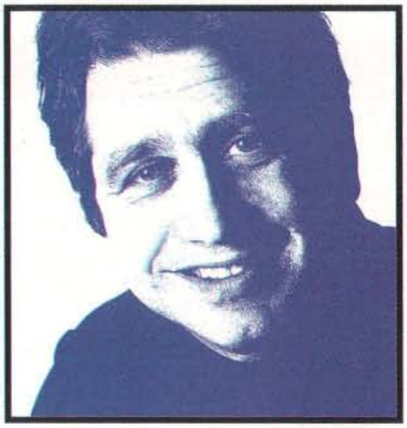
It's become equally clear to me that continuing to debate whether Windows, OS/2, the Mac, or Unix makes the best desktop is not the burning issue it used to be. Ditto for processors. They're all viable, and they all have problems. On the software side, they have roughly the same problem. In order to accommodate the very diversity that is their strength, these OSes have become complex and difficult to manage. They're all basically proprietary, and they're all fat clients, limited in their interoperability.

That brings us to Java. The most important decision today is not which desktop OS to adopt, but whether to stick with the general-purpose, proprietary desktop paradigm of the past 20 years or instead go with thin clients, fat servers, and platform-neutral software, such as Java-, HTML-, and HTTP-based packages. At BYTE, we think the issue is so important that we've devoted two covers in three months to it.

But life isn't always simple. When the PC overtook the minicomputer and the mainframe, these technologies didn't evolve much beyond absorbing PC technology. Don't bet on that happening with the PC-to-network-computer evolution. If Intel, Microsoft, and their partners respond to competitive pressures and take substantial amounts of difficulty out of managing the PC, that environment will evolve and remain viable for a long time. I hope these companies understand that failure to do so will ultimately consign them to niche status.

The key decision is not which desktop OS to adopt, but whether to stick with the paradigm of the past 20 years.

On the Java side, we all have some tremendous opportunities to blaze new ground, and not just as the champion of Son of Host Computing. For example, the growth of the Web and the Internet means that many developers work for non-IT companies that will be producing products and services that are essentially software; a package-tracking application is a good example. It's the perfect test case for Java: Build an application that can run on any customer's computer. And add to your company's revenues.



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But weigh the risks. Java's not yet ready for many big bet-your-business projects. And the Java industry has to prove that it can sustain broad interoperability without turning over the specification process for the language and the virtual machine to a standards body.

For years, we've been comparing luxury-car desktop environments. Now we need to be concerned about these new sport/utility vehicles as well. We will need to master them both to navigate the information-technology terrain of the late 1990s.

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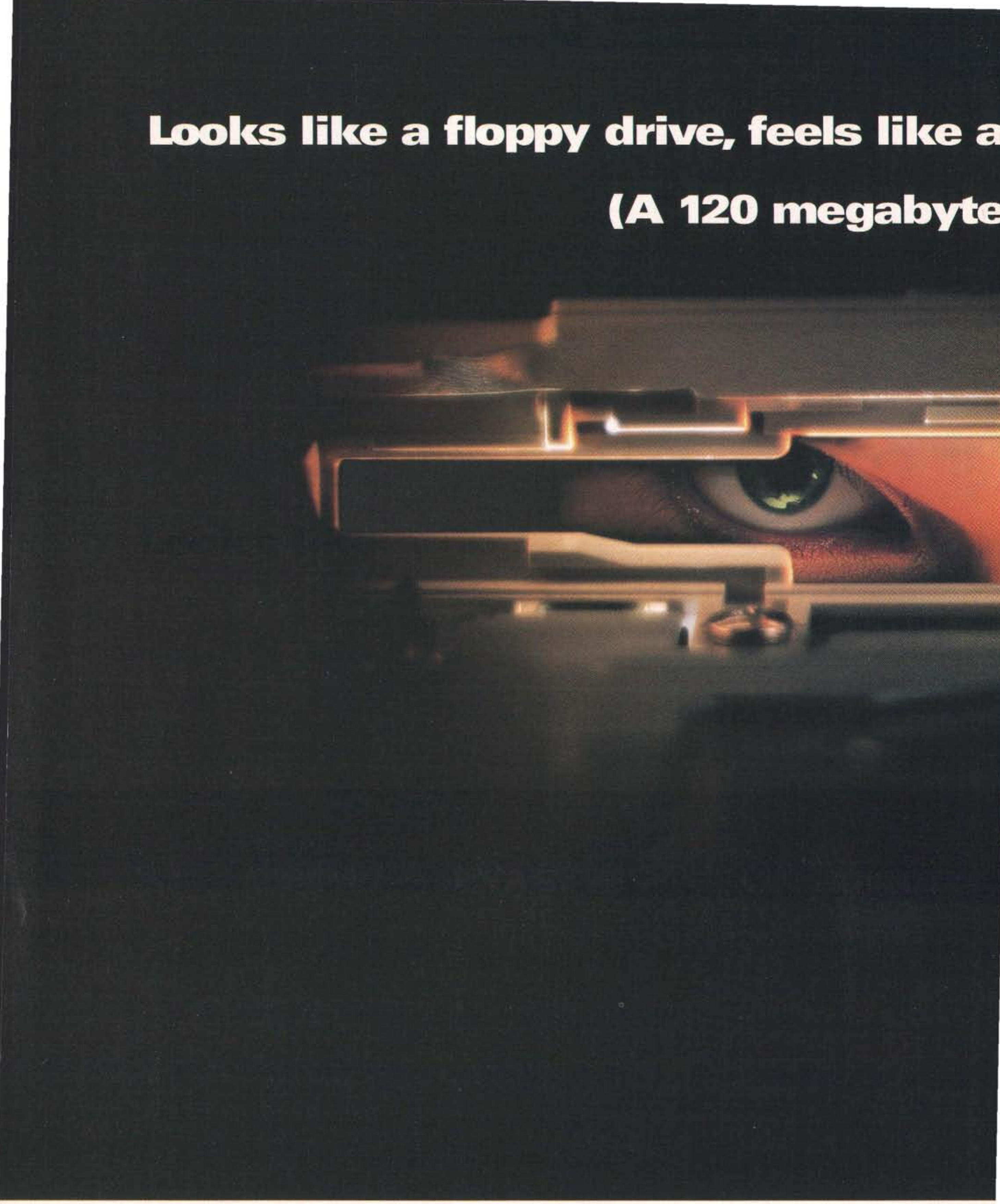

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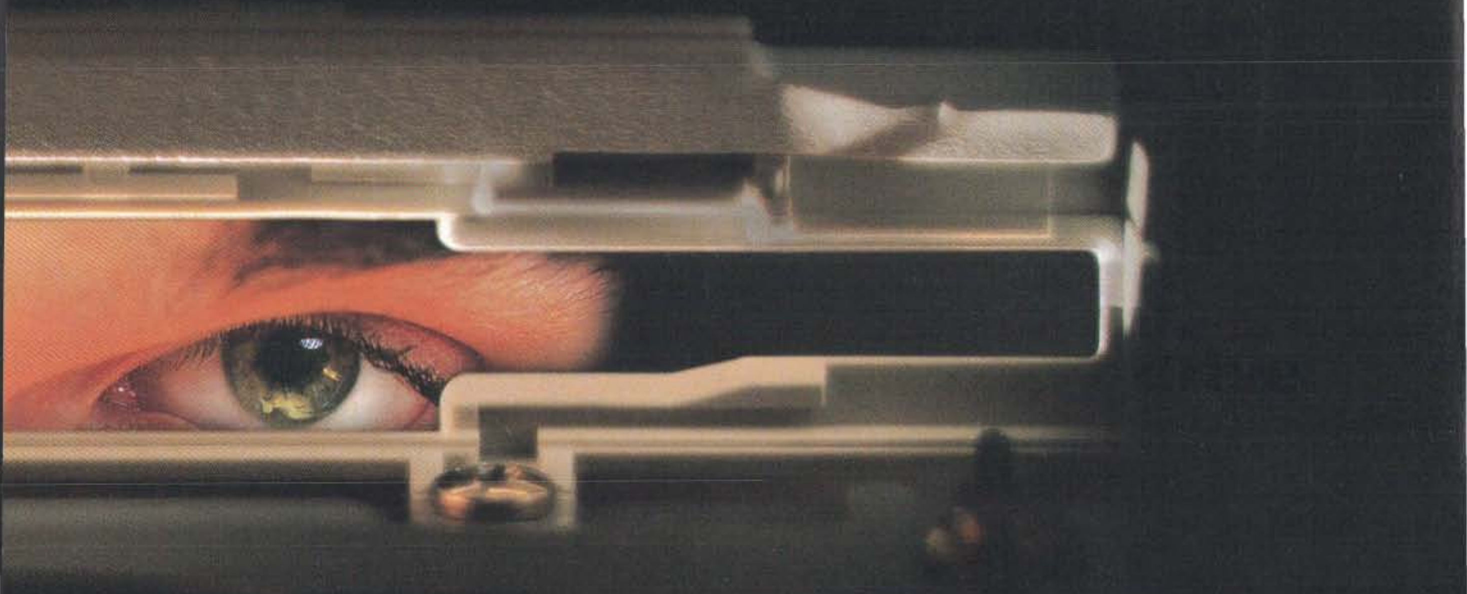

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inbox

OpenDoc Opens Up

Funny you should review OpenDoc ("An Open Window for OpenDoc," December 1996). I recently received two commercial document-processing products that use OpenDoc 1.1 on the Macintosh: Digital Harbor WAV 1.0 and Nisus Writer 5.0. I've been using Apple's Cyberdog and find it excellent for mixing and matching Internet-access items. OpenDoc seems to be good at combining things on the same page—something I could never get any version of OLE to do. Nisus Writer 5.0 is great at Japanese word processing, and WAV 1.0 simply amazes me. I've never seen text runaround or column formatting work so nicely. I expect great things from OpenDoc-based software.

Curt Risor
Bensalem, PA
72677.3650@compuserve.com

CT or MRI?

I enjoyed "How Microchips Shook the World" (December 1996). However, the picture you included with the text box "Computed Tomography for Everyone" on page 70 does not show a CT scanner, but an MRI (magnetic resonance imaging) scanner. While you could perhaps say that, in the broadest sense, MRI is actually CT because it uses computers to construct tomographic (i.e., slice) images of the body, *CT* normally refers to the modality that uses X rays to make these images. The points that the text box listed in regard to CT are also valid for MRI, however.

Alan A. Hobson, R.T.
ahobson@indy.net

Memory Lane

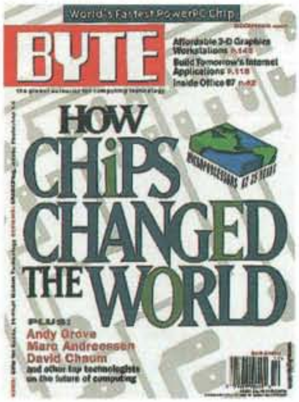
In the text box "Hardware Platforms with 64-bit Muscle" (November 1996 Special Report, page 144) you mentioned that the Pentium uses 64-bit arithmetic operations and internal data paths. But don't Pentiums also have a 64-bit path to main memory? In the article "The x86 Gets Faster with Age" in the same issue, Tom R. Halfhill states that the Cyrix 6x86 "handily beats a comparable Pentium" but that it can't match the higher core speeds of the Pentium and lacks MMX.

Why should Cyrix attempt to get the 6x86 to match the core speed of a Pentium when it has the ability to outrun the Pentium at a lower clock speed? And right now, all proccesors lack MMX. In my opinion, the 6x86 is a better chip than the Pentium, and it's less expensive, too.

Chris Nightingale
chrisn@planet.eon.net

Yes, it's true that the Pentium has a 64-bit I/O interface to main memory. The same goes for all fifth- and sixth-generation x86 processors.

Here's why it would be useful for Cyrix to make the 6x86 run at higher clock speeds: At 150 MHz, the 6x86 closely matches the performance of Intel's 200-MHz Pentium, but it can't match the performance of the 200-MHz Pentium Pro. If Cyrix chips could achieve higher clock speeds, they could compete directly with Intel's latest CPUs instead of Intel's last-generation CPUs. As I pointed out in my story, the 6x86's lack of MMX is not the main question—it's whether Cyrix can successfully design a CPU that's fully compatible with MMX. If Cyrix doesn't have access to the same intellectual property that Intel and AMD do, it will be more difficult for the company to devise a compatible solution.—Tom R. Halfhill, senior editor



BYTE on Copland

As one who has been quick to criticize the media for bad reporting with respect to Apple in the past, let me congratulate you on "Copland, Revisited" (November 1996 Special Report). You covered the good and the bad—as facts, without editorializing.

But while the comparison of Copland, Windows NT, and Unix in your Special Report contained an implicit assumption that they are different beasts, I'm not sure all readers understand this. There seems to be an assumption circulating that a single OS can cover the entire desktop-to-server continuum, one I don't believe is necessarily justified. Given Apple's strategy, one might easily compare an enterprise environment with Copland desktops and AIX servers against an NT Workstation/NT Server environment. Instead, many people insist on comparing, for example, the Mac OS or Windows 95 against Unix.

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The Wrong Message

In "GroupWise Sends a Message" (November 1996) Steve Gillmor indicates that GroupWise 5 initially runs only on Windows NT Server. Correctly stated, GW5 actually runs only on Novell 4.x servers, for the simple reason that GW5 requires NDS to be installed. It's definitely not an NT Server–only GroupWare product.
Phil Maloy
Novell Technical Services
GroupWare Support Department
pwmaloy@novell.com

Steve Gillmor's original copy read: "The product will run on Windows NT servers when it ships, with Unix and OS/2 versions to follow." During the editing process, this statement was inadvertently reworded to indicate that the initial release of GW5 runs only on Windows NT, which is clearly incorrect. We apologize for the error.—Eds.

Web Matters

In "Web Surveys" (October 1996 Web Project), Jon Udell says that "if you're in need of a lightweight Unix SQL engine to use in conjunction with these, try msql (http://www.bunyip.com/)." First, mSQL (note the correct capitalization) isn't free; it's shareware, and the author deserves all the help he can get to encourage people to pay for it. Your reference doesn't do much to help him get the word out. Second, mSQL is written and distributed by David J. Hughes, not Bunyip. In the early days of mSQL's development, Bunyip made use of it as a back end in a product, and we offered to host the mSQL mailing list, but there's no longer any mention of mSQL on Bunyip's home page. The correct uniform resource locator is http://www.hughes.com.au/software/.
Jeff Allen
jeff@bunyip.com

Thanks for the interesting article "Web Surveys." I'm using Omnicron Ohttpd server on Windows 95 and both Visual Basic plus ODBC and Perl/CGI to explore some ideas for talking to an Access database. I've been unable to locate odbc.pm. Can you point me in the right direction?
Michael Shellim
mshell@cix.compulink.co.uk

Since I wrote that article, I've upgraded from NT::odbc.pm to Dave Roth's newer and more full-featured Win32::odbc.pm. The Win32::ODBC home page is at http://www.roth.net/odbc/, and there's an FAQ at http://www.roth.net/odbc/odbcfaq.htm.—Jon Udell, executive editor

No Robots, Please

In the text box "Getting Along with AltaVista" (November 1996 Web Project), Jon Udell forgot to mention that support for the file `robots.txt` is not automatic. The indexer might simply choose to ignore it. We have the biggest computer-virus infobase on the Internet, and it has already been sucked by several competitors. In the process, they recursed through our entire directory tree, ignoring the exclusions. Beta versions, customer-support files, and so forth could easily have been taken along. A subdirectory is never really a safe place to store confidential or private data.
Pierre Vandevenne, M.D.
Neupre, Belgium
http://www.datarescue.com

Thanks for pointing that out. Obeying the directives in `robots.txt` *is just good manners, not a hard requirement. I should have made that clearer.—Jon Udell, executive editor*

HAL Speaks

"Unix Leads the 64-bit Charge" (November 1996 Special Report) failed to mention HAL Computer Systems' HALStation 300 series workstations. This computer has a 64-bit SPARC V9 processor of HAL's own design and a full 64-bit version of Sun's Solaris OS, which was ported by HAL and is compatible with existing 32-bit Unix applications. I hope that future articles about 64-bit computers, chips, and OSes will mention the HALStation. More information is available at http://www.hal.com.
Ed Pittman
HAL Computer Systems
epp@hal.com

Was That an NC?

A few months ago, a glasshouse industry consortium defined the network computer (NC) as a Java-ready diskless PC costing less than the price of a good filing cabinet. It now appears ("Inside the NC," November 1996) that the definition is broad enough to include any computer that runs mainstream Internet applications. How long before another article counts all the Java-ready machines on the Internet and declares the NC a raging success?

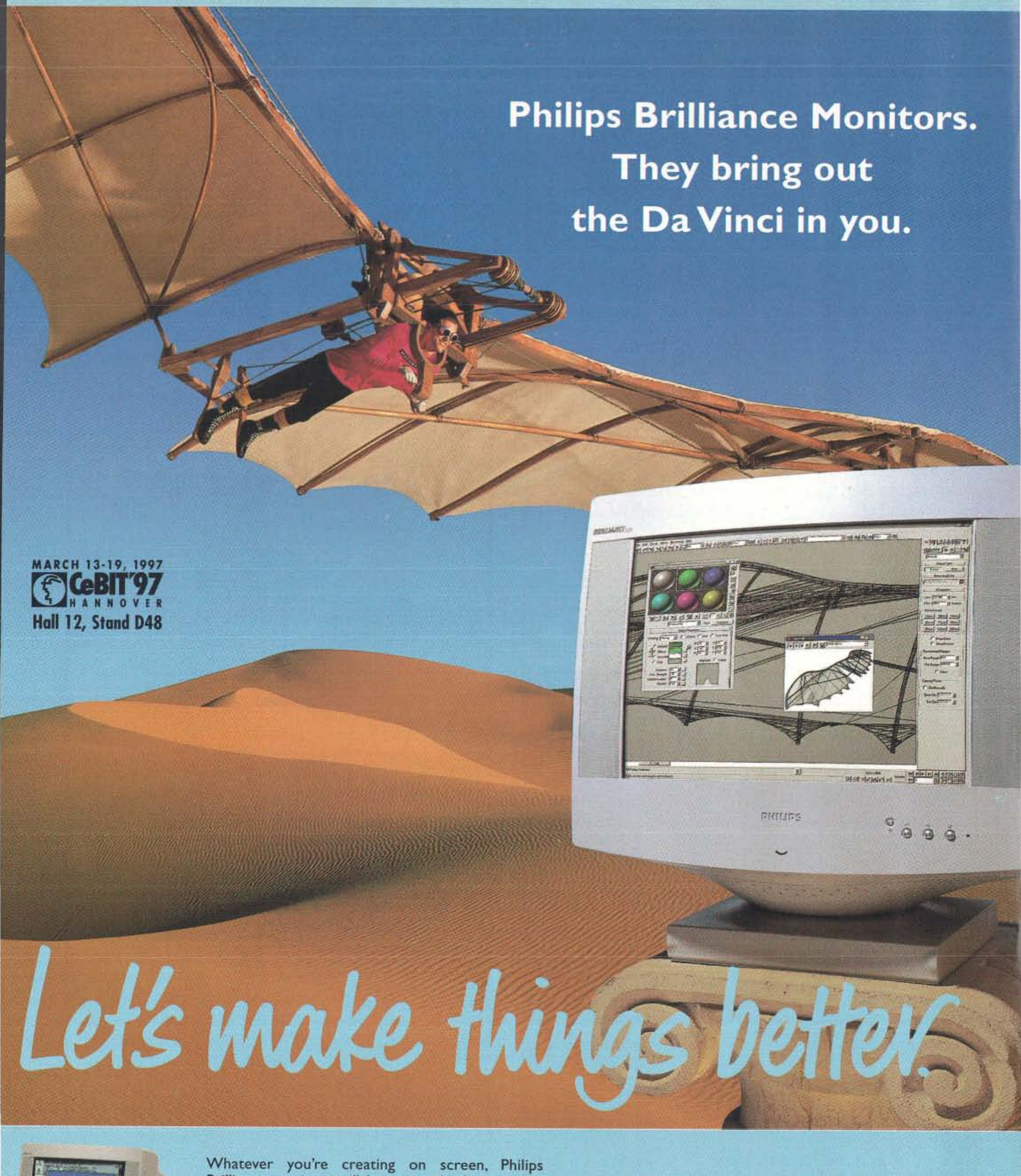
I wonder: My desktop easily meets the criteria. But if I tick the options that disable Javascript and Java in Netscape, or if I use GNNPress as my browser, does my NC turn back into a plain-old PC? If the NC is anything more interesting than an attempt to move the OS focus away from Microsoft and toward Sun, I've yet to see any evidence of it.
Marc Thibault
marct@hookup.net

The Java Race

"Sun Gambles on Java Chips" (November 1996) gives the false impression that there are only three horses in the Java race: software interpreters, just-in-time (JIT) compilers, and Sun's unproven Java chips. There is, in fact, a fourth horse: optimizing Java compilers that produce native code for conventional CISC and RISC processors. While they sacrifice run-time portability, their performance on nontrivial applications will almost certainly blow away the other alternatives—and I doubt that the market will be any more willing to sacrifice performance for run-time portability this time around than it has in the past.
John Navas
JNavas@NavasGrp.Dublin.CA.US

Netspeak

I enjoyed Mark Schlack's book review of *Sex, Laws, and Cyberspace* in the October 1996 issue (page 38). However, the authors' point that the Internet should be treated as a series of printing presses and bookstores may mean protection in the U.S., but it has exactly the opposite effect in other places. The current efforts of Scotland Yard to censor Internet



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providers in the U.K. are based on exactly this premise. In most European countries, you may not publish anything you want. You may, however, say whatever you want—and write it, too—if it's meant as personal communication.

In this context, comparison of the Usenet and e-mail via the Internet to verbal communication gives much more freedom to users. Arguably, the Web might be considered to be publishing. But to consider e-mail between friends or messages to a Usenet group as publishing seems to be stretching things. Is letter-writing or speaking to friends in public places also publishing? Should those activities be censored? That's the debate we should be having. The medium of communication is irrelevant.

Maggie Mulvaney
Auckland, New Zealand

COMING UP IN MARCH

COVER STORY

Netscape: The Strategy

Is Netscape's technology strategy on track? BYTE takes a hard look at Netscape's server technologies and APIs.

PLUS

Netscape Communicator

We review Netscape's new offering, which extends Navigator's reach with e-mail, conferencing, and personal information management.

FEATURES

Globalizing Software

BYTE examines the technical underpinnings of distributed applications for multinational enterprises, including the international characteristics of major OSes, leveraging unified character encoding, and dealing with encryption-export restrictions in building electronic commerce and other secure applications.

Linux in a Gray Flannel Suit

We take an IS manager's view of what Linux can offer–industrial-strength applications, built-in security features, Internet protocol support, and low hardware requirements–and what it doesn't: guaranteed technical support, mature development tools, and SMP.

REVIEWS

Hardware Lab Report

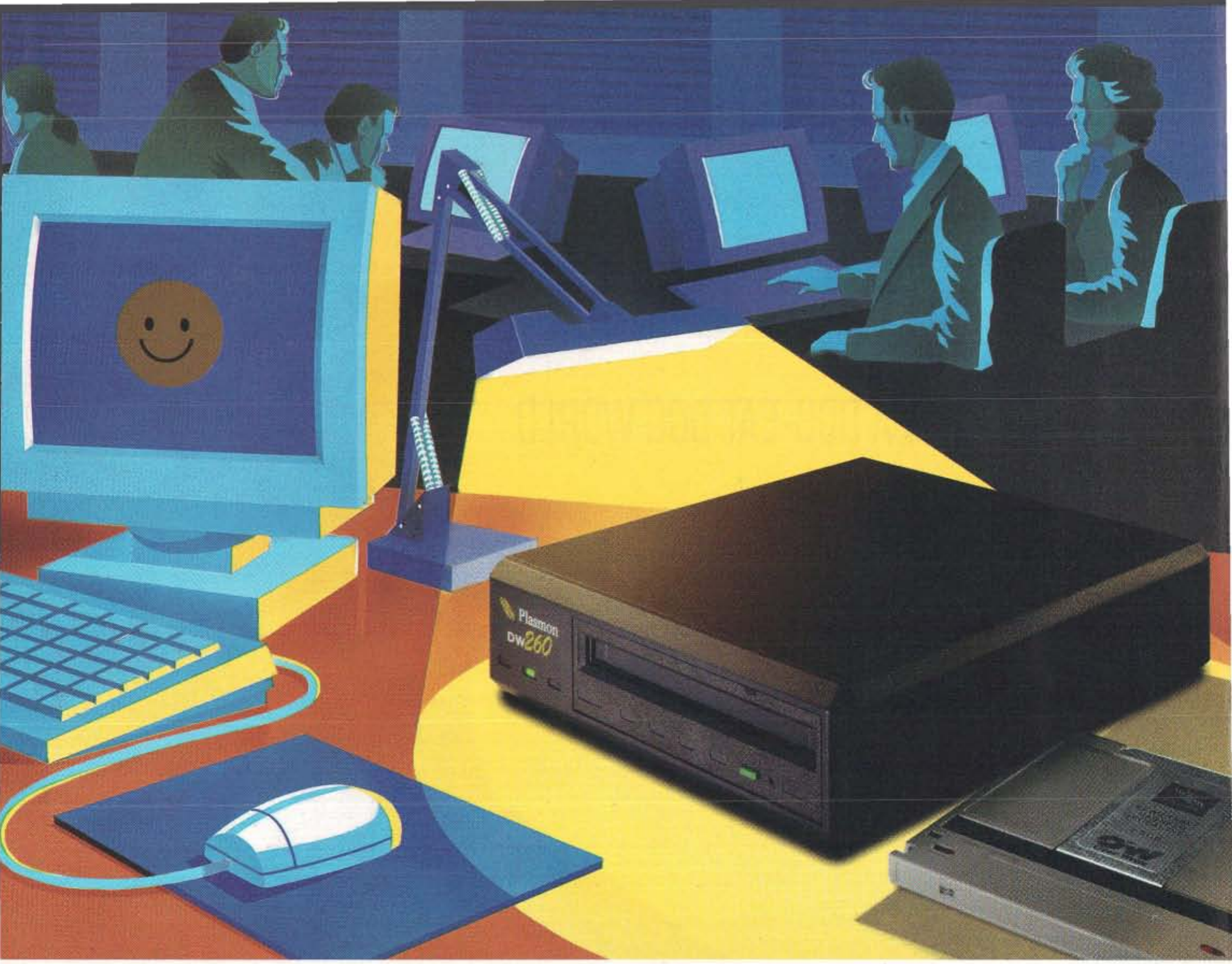
NSTL tests fast, 33.6-Kbps modems, with an eye on effective throughput and compatibility; plus: the latest on the emerging 56-Kbps standard.

C/S RAD in C++

We round up the latest tools–Blue Sky's Visual SQL, Microsoft's Visual C++, and Powersoft's Optima++–in this hot software development category.

Mac Hardware Comparison

We get our hands on Apple's Power Macintosh 9500/200 and systems from DayStar Digital, Motorola, Power Computing, and Umax.



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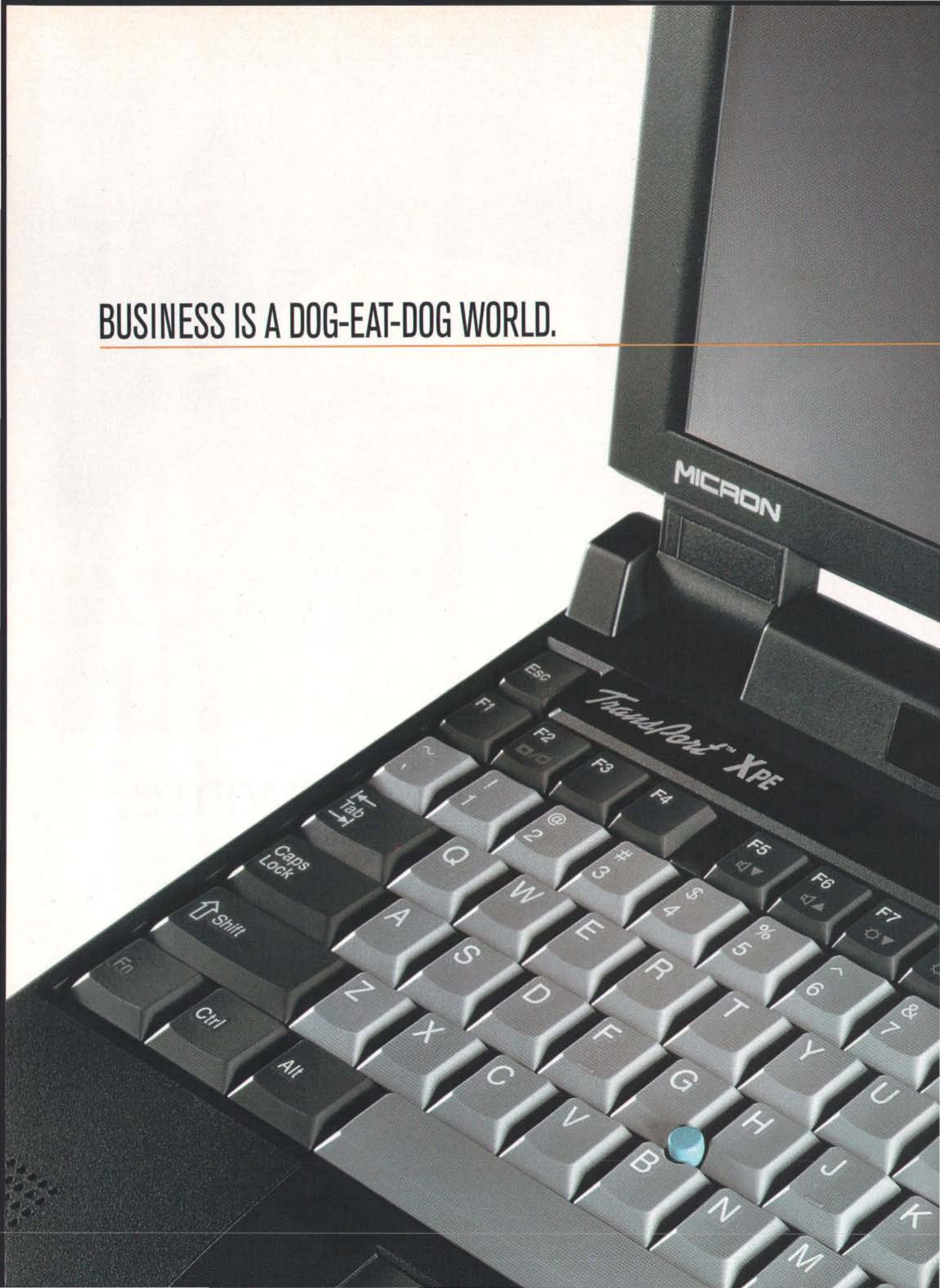
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MMX: Better in Fits and Starts

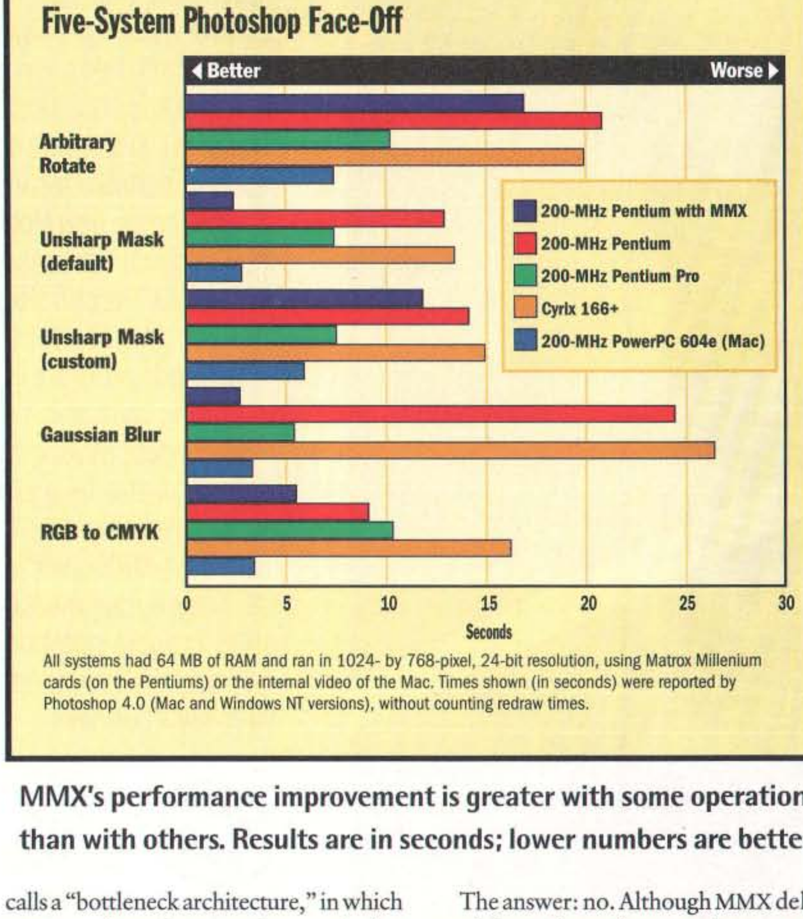
Tests of MMX systems and software reveal dramatic, but uneven, application performance improvements.

Intel's new Pentium processor with MMX technology delivers a performance advantage over older Pentiums running at the same clock speed. But the performance boosts BYTE saw while testing one of the first MMX-optimized applications running on an MMX PC were uneven compared to overall improvements delivered by the Pentium Pro.

To gauge MMX performance improvement, BYTE ran Adobe Photoshop 4.0 on five systems, including three PCs from Polywell ((800) 999-1278), one of which uses the newest Pentium processor (aka the P55C). The Windows version of the new Photoshop takes advantage of the P55C's MMX architecture.

As noted previously in BYTE (see "x86 Enters the Multimedia Era," July 1996), the P55C has 57 new instructions to accelerate MMX-optimized applications' video, graphics, animation, and sound performance. However, the processor also provides 16 KB each for the primary instruction and data caches, double that of previous Pentiums. Intel reckons that even current applications not optimized for MMX will see performance boosts of 10 percent to 20 percent. Applications optimized for MMX should see even better improvement than that, depending on how aggressively they have been tuned. Except for applications optimized for MMX, today's Pentium Pro is still the performance champ for 32-bit or floating-point-intensive applications.

Many multimedia and games developers are optimizing for MMX, as are Adobe competitors, such as Corel. BYTE saw impressive improvements in MMX-optimized 3-D applications and games, but, unlike Photoshop 4.0, those applications were in prerelease stage.



All systems had 64 MB of RAM and ran in 1024- by 768-pixel, 24-bit resolution, using Matrox Millenium cards (on the Pentiums) or the internal video of the Mac. Times shown (in seconds) were reported by Photoshop 4.0 (Mac and Windows NT versions), without counting redraw times.

MMX's performance improvement is greater with some operations than with others. Results are in seconds; lower numbers are better.

Photoshop has long had what Adobe calls a "bottleneck architecture," in which compute-intensive operations are isolated. This approach allows developers of hardware accelerators or multiprocessing systems to write custom code to accelerate time-consuming processes. Adobe's claims that performance might jump two to six times with MMX processors made us wonder if Pentiums with MMX technology will outperform a high-end Macintosh. Photoshop is often run on dedicated workstations on a network. Could an MMX Pentium outperform a high-end Macintosh?

The answer: no. Although MMX delivered dramatic performance in some operations (see the chart above), overall, a high-end Mac still beats an MMX Pentium. BYTE tested three 200-MHz systems from Polywell: a standard Pentium, an MMX Pentium, and a Pentium Pro. In addition, we tested Apple's Power Mac 9500/200 and a Cyrix P166+–based PC.

Using a high-resolution RGB image (8.17 MB), we copied the file to every system's local hard drive and installed Photoshop. We repeated each test at least three times, reverting to the original or undoing the operation each time, using Photoshop's internal timer, and taking the arithmetic mean of the results. The tests are as follows.

Arbitrary Rotate. Sometimes used for squaring up scans and otherwise used as a special effect, arbitrary rotation uses floating-point calculations, which is why the Pentium Pro beat the P55C in this test. We used 7 degrees clockwise.

Unsharp Mask. To overcome the loss of apparent sharpness in printed halftones, almost every image that passes through Photoshop has this filter applied. We tested this with two settings: first with the default values (50 percent, radius of 1 pixel, no threshold), and again with more-demanding custom values (50 percent, radius of 10 pixels, threshold of 5). While these values were excessive for the image under test, a radius of several pixels and some threshold will normally be used in production. While most images need more than the default, the default test is one in which MMX really shines.

Gaussian Blur. This filter is often used to remove scanner artifacts and to throw distracting backgrounds out of focus. We used the default value of a 3-pixel radius. In this test, the MMX again beat all other systems.

RGB to CMYK. Normally the last step of every file being prepared for print. For this test, we used the default Photoshop color tables. The MMX chip had an advantage over the existing Pentium architecture, but it still fell behind the Mac.

For most production Photoshop users, the custom Unsharp Mask filter is the most important test. This filter is used regularly. RGB-to-CMYK conversion and Arbitrary Rotate are the next most important tests.

Overall, even without weighting the results to reflect this, the high-end Macintosh system beats the MMX Pentium. But the MMX system ($2996 as tested) delivered slightly better performance than the high-end ($4429 as configured) Mac in two tests. MMX definitely improves the performance of optimized applications, and at a cost of $550 each (200-MHz version) for PC makers, the first MMX chips cost only $41 more than the current 200-MHz Pentium chip. The jury is still out on other MMX applications. BYTE will test more MMX-optimized applications in upcoming issues, but Photoshop 4.0 portends higher-performing Windows programs to come.

–G. Armour Van Horn

geek mystique

Internet by the Numbers

More interesting numbers highlighting the Internet's popularity, as compiled by Win Treese (treese@OpenMarket.com):

- **Number of e-mail address entries per person on the MIT alumni contribution form: 2**
- **Number of U.S. states publishing wanted lists of child-support offenders on the Internet: 7**
- **Percentage of comics in the Boston Globe with Internet addresses: 63**
- **Percentage of the first 20 ads appearing in the October 1996 issue of Scientific American that contain Web addresses: 75**
- **Percentage of the first 20 ads appearing in the October 1996 issue of Scientific American that contain toll-free phone numbers: 70**

Wanted: Legacy Coders

Legacy code returns as the latest fashion? The so-called year-2000 problem has created a need for COBOL programmers. Peter Ernst, a branch manager in Woburn, Massachusetts, for General Employment Enterprises, a Chicago-based technology search firm, confirms that his company will even recruit qualified programmers out of retirement. Comments Ernst: "We've primarily seen an increase in the need for contractors, but we've seen demand increase for full-time programmers as well."

Office 97 Wins Best of Comdex

Office 97, the newest version of Microsoft's leading office suite for Windows 95, won BYTE's Best of Show award at the recent Fall Comdex '96 show. But although it took top honors, Microsoft was not alone among companies showing new products that are innovative or likely to significantly impact the microcomputer industry.

The most recent Comdex may be remembered as the one in which products based on digital videodisc (DVD) and universal serial bus (USB) arrived in full force. Other products that attracted a considerable amount of attention were new Windows CE–based hand-helds, Java development tools and applications, and speech-recognition programs.

In addition to winning Best of Show, Microsoft's (Redmond, WA, http://www.microsoft.com/office) Office 97 was also named Best Application. It adds a wealth of new features to its popular desktop applications, plus the new Outlook e-mail/personal manager/calendaring application. Finalists were Stratus's (Marlborough, MA, http://www.stratus.com) Isis for Database-ODBC, a database companion that adds continuous availability and protection against system crashes, and Corel's (Ottawa, Ontario, Canada, http://www.corel.com) Office for Java, a Java-based cross-platform application suite that's slated to ship in the first quarter of this year.

Best Technology winner was the Chinese speech recognition from the Lexicus Division of Motorola (Palo Alto, CA, http://www.mot.com/lexicus/). It delivers continuous voice dictation for people speaking the mandarin dialect; Motorola hopes to commercialize the technology in the first half of this year. The finalists in this category were Microsoft's Windows CE OS for hand-held computers and the emerging DVD storage standard from Hitachi, Philips, Pioneer, Sony, Time Warner, and Toshiba.

Two new Web programs from one company won the Best Web Product category:

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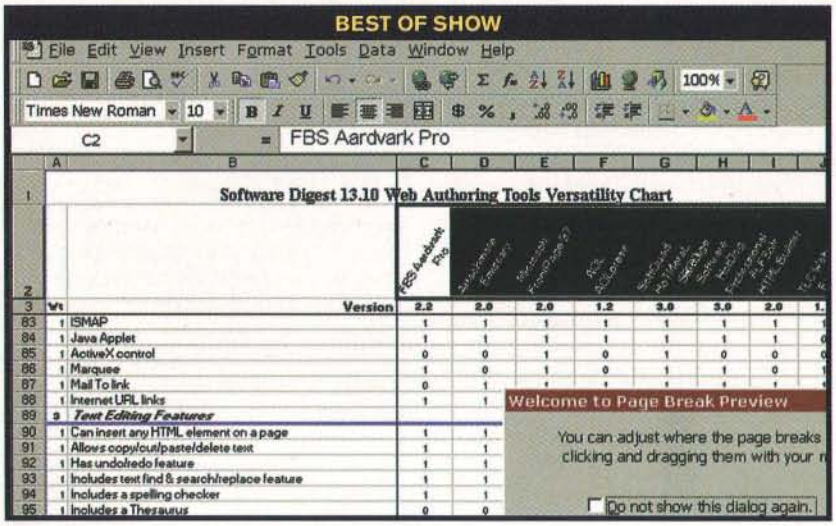
BEST OF SHOW



Software Digest 13.10 Web Authoring Tools Versatility Chart

	A	B	C	D	E	F	G	H	I
2			FBS Aardvark Pro						
3	Wt	Version	2.2	2.0	2.0	1.2	3.0	3.0	2.0
83	1	ISMAP	1	1	1	1	1	1	1
84	1	Java Applet	1	1	1	1	1	1	1
85	1	ActiveX control	0	0	1	0	1	0	0
86	1	Marquee	1	0	1	0	1	1	0
87	1	Mail To link	0	1					
88	1	Internet URL links	1	1					
89	3	*Text Editing Features*							
90	1	Can insert any HTML element on a page	1	1					
91	1	Allows copy/cut/paste/delete text	1	1					
92	1	Has undo/redo feature	1	1					
93	1	Includes text find & search/replace feature	1	1					
94	1	Includes a spelling checker	1	1					
95	1	Includes a Thesaurus	0	0					

Welcome to Page Break Preview

You can adjust where the page breaks
clicking and dragging them with your

☐ Do not show this dialog again.

Office 97's new print-preview features should save a few trees.

Communicator and Constellation, from Netscape (Mountain View, CA, http://www.netscape.com). Communicator combines the latest Navigator browser (version 4.0) with e-mail, workgroup, and conferencing software and other components, while Constellation is a new cross-platform desktop environment that provides a new interface for customizing and organizing information. Finalists were Vosaic, from Vosaic LLC (Chicago, IL, http://www.vosaic.com), which delivers high-quality streaming MPEG video over the Internet, and Digital's (Littleton, MA, http://altavista.software.digital.com) AltaVista Search My Computer Private eXtension, a powerful search tool for desktop and Intranet applications that costs about $30.

Wyse Technology's (San Jose, CA, http://www.wyse.com) 200-MHz Strong Arm 110 CPU-based Winterm 4000 Series Enhanced Network Computers, which support the new network-computing model and offer access to legacy hardware (and, soon, shared remote Windows applications), won for Best System. Finalists were the upgradable Archistrat 4s-NXS workstation, by The Panda Project (Boca Raton, FL, http://www.archistrat.com), and Madura, by Flat Connections (Fremont, CA, http://www.flatconnect.com), a system that crams a RISC processor, a 33.6-Kbps modem, RAM, ROM with a Java engine, and RSA security onto a PC Card.

The winner for Best Laptop was Texas Instruments' (Temple, TX, http://www.ti.com) 5.1-pound Extensa 900 Series Notebook, which provides top-of-the-line features, such as an eight-speed CD-ROM, a 12.1- or 11.3-inch display, and a Zoom video PC Card slot. The finalists were Fujitsu's (Milpitas, CA, http://www.fujitsu-pc.com) ultralight LifeBook 600 Series and Apple Computer's (Cupertino, CA, http://www.newton.apple.com/) eMate 300, a rugged 4-pound Newton OS–based portable designed for the education market.

Best Hand-Held winner was Philips' (Sunnyvale, CA, http://www.velo1.com) Velo 1, a hand-held based on the new Windows CE OS with a built-in modem that delivers strong PC connectivity. The finalists were Hewlett-Packard's (Palo Alto, CA, http://www.hp.com/handheld) new Palmtop PC for Windows CE, which offers a 640- by 240-pixel display that's wider than that of other Windows CE devices, and the Apple MessagePad 2000, from The Information Appliance Division of Apple Computer (http://www.newton.apple.com/). The new MessagePad boasts a powerful 160-MHz StrongArm processor.

Symantec's (Cupertino, CA, http://www.symantec.com) Visual Cafe Pro, a visual rapid application tool for developing applications and applets that connect to relational databases, won for Best Development Software. Finalists were Borland's (Scotts Valley, CA, http://www.borland.com) Open J Builder "Latte," a

future watch

The Easiest Network Connection You'll Ever Make

New solutions that enable you to use your home's existing electrical AC wiring to connect computers, TVs, and other communications devices have arrived, and some vendors are predicting faster, Ethernet-like speeds for 1997. The idea is that instead of running new wires through your house to network a printer, TV, and/or modem, you connect these devices using transmitter/receiver combinations that plug into your electrical outlets. Then, to network a PC, TV, or printer, you simply plug it into an AC outlet.

Elcom Technologies (Malvern, PA, http://www.elcomtech.com) already offers a range of products for connecting TVs, PCs, and other devices by sending signals over your home's AC wiring. Many of these products sell for $150 or less; for example, the company's ezOnline System ($129) enables you to access a computer modem or fax/telephone line running at up to 33.6 Kbps from any room in the house without requiring additional telephone lines.

Wyse Technology (San Jose, CA, http://www.wyse.com) is working on even-faster AC network solutions. The company says that, through compression techniques and by building a controller chip with improved algorithms that reduce noise in electrical currents, it has built an adapter that supports network connections that operate at about 100 Kbps through electrical outlets. By the end of the year, Wyse hopes to achieve speeds of 10 Mbps.

Wyse addresses security concerns with a scheme that requires security numbers for each authorized user. It isn't possible to send information across distributor transformers, so the current applications target the home and small office. Wyse's first products in this category will work with the company's Winterm thin-client devices. Look for other announcements of this type as more companies deliver easy and inexpensive networked computing solutions to the home.

–Jason K. Krause

Imagine the productivity gains from a 5X boost in data transfer. Raidtec Fibre Channel Now.

Raidtec Fibre Channel leaves other data transfer technologies in the dust...

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visual Java development tool, and Borland's C++ Builder "Ebony," a C++ RAD development tool.

Play, Inc.'s (Rancho Cordova, CA, http://www.play.com/), Trinity PC-based video-production system for broadcast-quality production won for Best Multimedia Hardware. Finalists were miro's (Palo Alto, CA, http://www.miro.com) miroVideo DV100, which directly accepts digital camera output, and Ricoh's (West Caldwell, NJ, http://www.ricohcpg.com) RDC-2 digital camera, which sports an optional LCD viewer and records sound as well as video.

In the Best Multimedia Software category, Apple's QuickDraw 3D 1.5 won due to its cross-platform nature and ability to support multiple renderings from the same 3-D model. Finalists were Voice Pilot Technologies' (Miami, FL, dslach@ibm.net) Voice Pilot for Windows 95 voice-command and dictation program and MGI Software's (http://www.mgisoft.com) MGI VideoWave, a consumer-level video-editing application.

BEST LAPTOP

TI's Extensa notebook packs many features into a 5.1-pound package.

The award in the Best Connectivity Hardware category went to Xircom's (Thousand Oaks, CA, http://www.xircom.com) CardBus Ethernet 10/100 Adapter, a 32-bit CardBus 10-/100-Mbps Ethernet adapter. Finalists were Cardinal Technologies' (Lancaster, PA, http://www.cardtech.com) 5210-Cardinal Upgradable Modem, which is ISDN- and 56-Kbps-ready, and CNF's (Morgan Town, CA, http://www.cnfinc.com) Digitari Universal Dockstation for Notebooks, which provides connectivity for notebook computers from a variety of vendors.

Winner of the Best Connectivity Software award was IBM's (Armonk, NY, http://www.hursley.ibm.com) MQSeries commercial messaging middleware, which provides reliable data transfer between distributed applications. Finalists were Nterprise, from Exodus Technologies (Bellevue, WA, http://www.exodustech.com), which delivers NT and Unix applications on a Unix workstation, and Sequel Technologies' (Bellevue, WA, http://www.sequeltech.com) Sequel Net Access Manager, which enables network administrators to manage their Internet usage.

BEST CONNECTIVITY HARDWARE

Xircom's Ethernet 10/100 Adapter supports the 32-bit CardBus standard.

Octopus Technologies' (Yardley, PA, http://www.octopustech.com) Octopus for Windows NT, which offers real-time server and data protection, won for Best Utility. The finalists were Acceleration Software International's (Seattle, WA, http://www.accelerationsw.com) Superfassst Windows acceleration software and Trend Micro's (Cupertino, CA, http://www.antivirus.com) ScanMail antivirus program for Microsoft Exchange Server.

Best Peripheral winner was Seagate's (Scotts Valley, CA, http://www.seagate.com) fast Cheetah hard drive. Peripheral finalists were ViewSonic's (Walnut, CA, http://www.viewsonic.com) PV140 ViewPanel, a 14-inch active-matrix LCD monitor, and Delorme's (Freeport, ME, http://www.delorme.com) spiffy Tripmate GPS receiver/software bundle.

Bug of the Month

Unhinged

A laptop's case hinges on two thin pieces—literally and, at times, figuratively. For instance, my ThinkPad's hinges snapped when I tried to use it after a hiatus of six months; another BYTE reader's laptop broke three times in two years; and many palmtop users are complaining on Usenet.

Jim Carroll of Computer Hut's service center in Nashua, New Hampshire, says broken hinges are a common problem in many vendors' portable computers. "It happens with all brands, including Compaq, IBM, and Toshiba," he explains. "The hinges are the first things to go." Carroll attributes the problems to regular use, abuse, and sometimes even shoddy design.

In normal use, accumulated dust can impede hinges to the point where the plastic casing breaks. Subsequently, tiny screws are free to rattle around and short out the electronics. Carroll says that when major electrical components go on the fritz, it might actually be more practical to replace a laptop than to repair it. Once you notice the hinges getting tight, seek service right away, he advises. A preventive lubrication now can prevent big headaches later.

The hinges' small size makes them particularly vulnerable to damage from abuse or constant use. Things to avoid include closing the laptop's lid on a writing utensil, overzealously snapping the case open and shut, carrying the laptop by the lid with the case hanging open, and spilling a drink on the laptop.

In addition to complaints about laptop hinges in general on Usenet, we found hinge-problem-related postings from Psion 3A and Siena laptop owners. But Psion representatives reckon that less than 1 percent of Psion repair jobs are for broken hinges. Rich Brandeis, Psion operations supervisor, says that "many of those customers admit to having bent the hinges themselves."

Broken hinges left this ThinkPad flat on its back.

An IBM spokeswoman says the current ThinkPad hinges are problem free. In any case, be nice to your portable's hinges; like you, they're probably under a lot of stress.

–Selinda Chiquoine

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Pricey Portable Repairs to Stay

Mobile computer users have always paid a premium for the convenience of notebook computers, trading the benefits of mobility for an expensive technology that's usually one step behind the current generation of desktop computers in terms of features and performance. But many users don't realize that they also pay a premium for maintenance, with high costs for repairs and support.

Supporting a mobile work force is generally harder than supporting desktop workers, according to Dick Caro, senior consultant for Arthur D. Little. One reason is that mobile users often must operate in three different modes: connected to a network while in the office, communicating with the office from a hotel, and isolated in an airplane. "Those three environments need the right procedures and support files to allow for those different modes of operation," he explains. Furthermore, new generations of "cycle-eating software" accelerate notebook obsolescence.

Higher parts prices, more proprietary parts, and a higher failure rate all combine to raise the overall maintenance costs for notebook computers. "You have more repair events for a laptop computer versus a desktop machine," says Greg Longtine, vice president of Operations at Computer Services of America (Manchester, NH), a service management company that repairs portables. "The mean time between failure is about half that of desktop computers due to the mobility issue. When you're putting a notebook computer into a suitcase, that has a profound impact on repairs."

And when you need repairs, you'll pay more. Longtine estimates that overall, parts for notebook computers cost 20 percent to 30 percent more per repair than parts for desktops. And that doesn't include the screen, which can cost $1100 or more to repair in an active-matrix design. Vendors also charge a premium for "genuine" replacement parts.

The most common sites for notebook failures include the screen, hard drive, and main logic board, according to Longtine; the motherboard is vulnerable due to constant device connection and disconnection, which take their toll. Other failure points include the keyboard, floppy drive, case hinges, pointing devices, modular drive bays, and PC Card slots.

Notebook users tend to need fast turnaround, and your local reseller or service provider probably can't handle notebook repairs. Because such repairs can take up to several weeks, Longtine recommends buying the vendor's extended warranty when available. The better programs include a loaner machine.

Don't expect these costs to change anytime soon. "Costs [to repair notebooks] will always be more expensive than for desktops," says Longtine. "Prices will come down, but they'll always be more than they are in the desktop market."

Nonetheless, notebook computers make good economic sense for people who require computing power on the road. So, if you need a notebook computer, what does a service expert recommend? Says Longtine: "I would buy an NEC [Versa] or IBM [ThinkPad]." Another option: Ruggedized notebooks, offered by vendors such as Badger (Tampa, FL), fieldWorks (Eden Prairie, MN), Itronix (Spokane, WA), and others, can reduce failures due to accidents or careless use.

–Rob Mitchell

Parts Prices: Laptop vs. Desktop

You'll pay more for laptop parts.

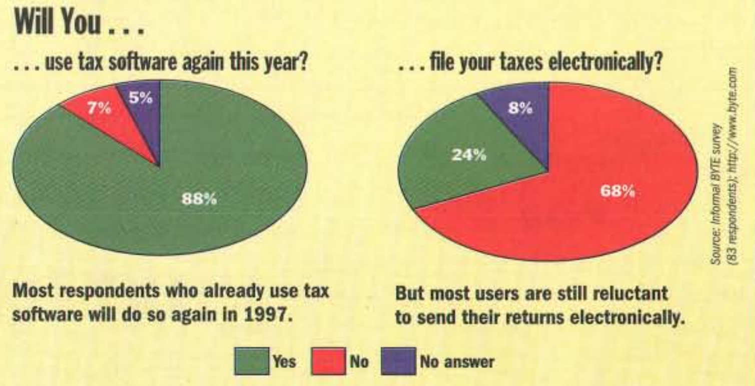
Notebook	Screen	Motherboard	Hard Drive
AcerNote Light 359	$1300	$900	$250
Compaq LTE 5250	$1400	$1300	$250
IBM ThinkPad 760ELD	$1000	$1150	$250
TI Extensa 570CD	$1500	$1000	$250
Desktop PC	$235	$350	$185

Laptop price source: Computer Services of America. Desktop parts prices shown are averaged from a variety of vendors for a 14-inch monitor, a 120-MHz Pentium, and a 1.08-GB hard drive. All prices are subject to change.

Survey

Reluctant and Leery of Filing Electronically

This month's survey indicates that although users like the efficiency, accuracy, and flexibility of tax-preparation software, they prefer to mail their returns the old-fashioned way instead of filing them via modem to an intermediary. Users offered numerous reasons for their reluctance to file taxes electronically, including concerns over lack of security and the $14.95 filing fee in the U.S. The vast majority of users who will file electronically said they do so to get their refund faster. Users who have to pay expressed no great desire to send that money to the government more quickly. More on this next month.

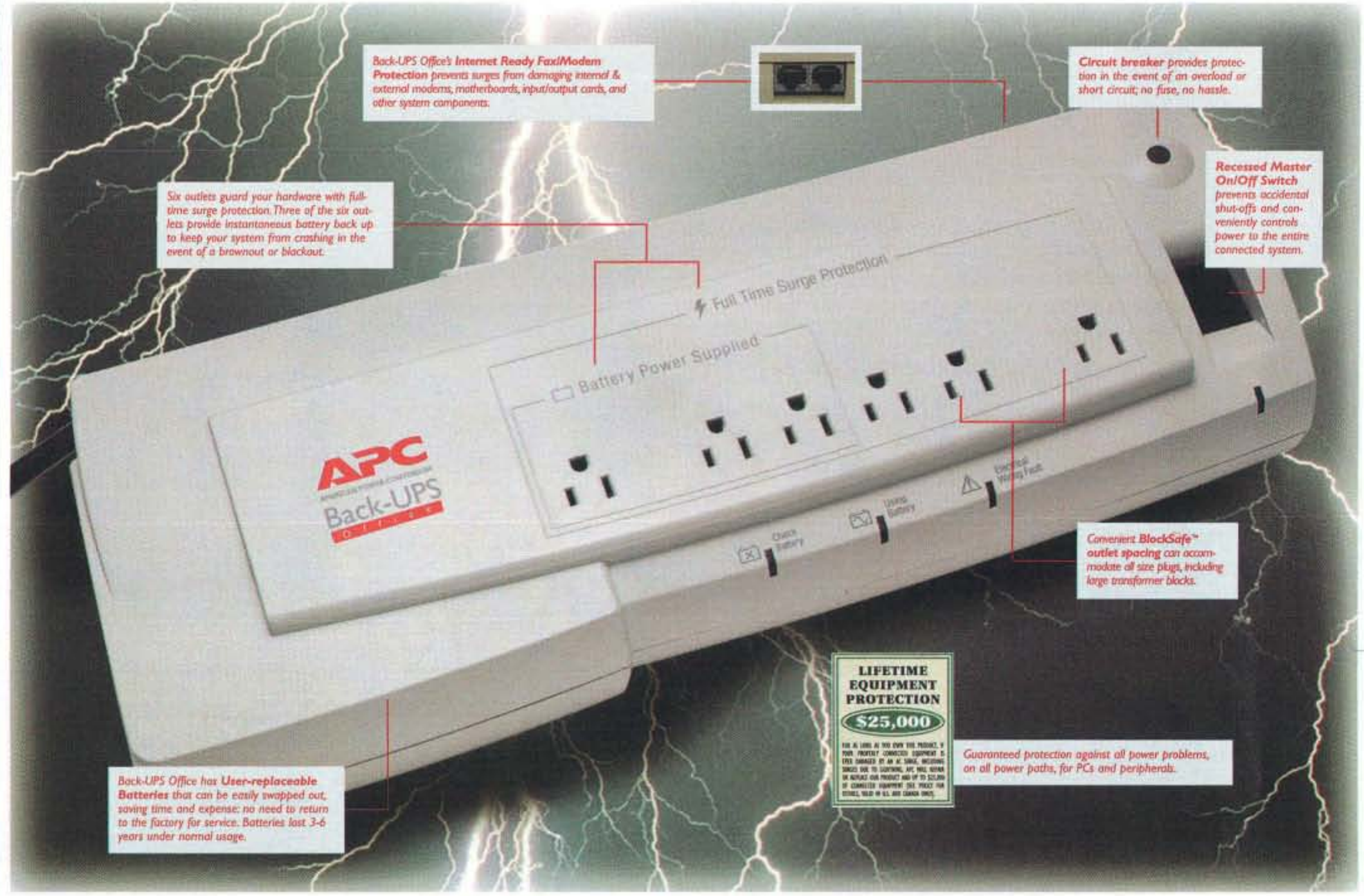


Most respondents who already use tax software will do so again in 1997.

But most users are still reluctant to send their returns electronically.

Source: Informal BYTE survey (83 respondents); http://www.byte.com

"They thought my new Multipath™ Back-UPS® Office™ was just a big surge suppressor – then the lights went out."



Back-UPS Office's ***Internet Ready Fax/Modem Protection*** *prevents surges from damaging internal & external modems, motherboards, input/output cards, and other system components.*

Circuit breaker *provides protection in the event of an overload or short circuit; no fuse, no hassle.*

Six outlets guard your hardware with full-time surge protection. Three of the six outlets provide instantaneous battery back up to keep your system from crashing in the event of a brownout or blackout.

Recessed Master On/Off Switch *prevents accidental shut-offs and conveniently controls power to the entire connected system.*

Convenient ***BlockSafe™ outlet spacing*** *can accommodate all size plugs, including large transformer blocks.*

Guaranteed protection against all power problems, on all power paths, for PCs and peripherals.

Back-UPS Office has ***User-replaceable Batteries*** *that can be easily swapped out, saving time and expense: no need to return to the factory for service. Batteries last 3-6 years under normal usage.*

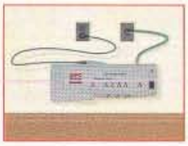
At last, a safe place to plug everything: Multipath Back-UPS Office for workstations, PC's and peripherals

Facing the darkness is hard, but inevitable: You have a better chance of winning the lottery than of escaping power problems: They're the single largest cause of computer data loss and hardware damage.

Back-UPS Office provides reliable power for your entire system. Instantaneous battery backup ensures uninterrupted operation of your CPU, monitor and an external storage device. Full-time surge suppression and site-wiring fault protection spreads a true Multipath™ safety net under any remaining integrated peripherals, like modems, printers, faxes and phone systems. Back-UPS Office also provides convenient BlockSafe™ outlet spacing to handle all size plugs – even large block transformers.

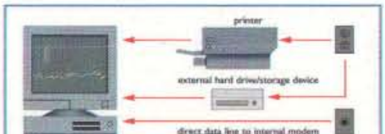
Unique Multipath protection keeps your PC and data safe

Plugging a phone line into your computer doubles your vulnerability to power problems; add any peripheral, and it triples. Even if your AC power-line is shielded, when a surge hits an unprotected peripheral, it can blaze down serial and data lines, and toast your expensive PC.

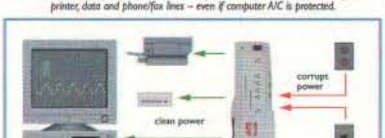


Back-UPS Office's compact design installs easily on desktop, floor or mounts to wall.

Multipath™ Means Total Power Protection


printer
external hard drive/storage device
direct data line to internal modem

Bad power (red) can enter a computer system through multiple paths – eg. printer, data and phone/fax lines – even if computer A/C is protected.



The Multipath™ protection of Back-UPS® Office™ shields your peripherals and guards your computer from bad power on every path, providing clean, safe power (green), to your entire system.

Multiple peripherals and data lines to and from your system are vital, but dangerous. Without them, you can't do your job. However, if a power sag makes your modem drop the line while you're downloading from the Internet, or locks your keyboard before you've saved work, you lose time, money and spend another late night at the office to meet your deadline.

Back-UPS Office protects your entire system

Until now, protection for your entire system required several devices. But multi-device protection can leave you vulnerable to line noise and unwanted data glitches created by the voltage differential between outlets. Those glitches are prevented with the Back-UPS Office common voltage reference.

Back-UPS Office means true Multipath™ protection, clean, safe power to every peripheral, and instant battery backup to keep your cutting edge system and O/S from crashing. It means protection for less by integrating the security of a surge suppressor with the power of a UPS, guaranteed up to $25,000.

"Back-UPS Office [is] a shoo-in for the small-office/home-office computing market and for general desktop workstations"
-Computer Reseller News

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Data			•
Phone			•
Total Outlets	7	2	6
Number of Block Outlets			2
Protection from			
Surges	•	•	•
Spikes	•	•	•
Blackouts		•	•
Brownouts		•	•
Overvoltages			•
Typical Runtime in Minutes			
with Pentium 100 w/15" monitor		10	10
Battery backup for			
PC		•	•
Monitor		•	•
Storage Devices/Zip Drives			•
Full-time surge protection for			
Fax/Modem	•		•
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Speakers	•		•
Dataline protection for			
Internet or Network			•

Traditionally, protecting all your equipment meant buying a surge suppressor and a UPS. Even then, only your AC line was protected. New Back-UPS Office protects all paths to your equipment: Bulletproof Multipath protection

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57 Varieties of Internet Faxing

The total expenditure by Fortune 500 companies on international faxing is around \$15 million per year, which accounts for 41 percent of those companies' telephone bills, according to a 1996 Gallup/Pitney Bowes survey. Meanwhile, options for routing international faxes over the Internet rather than via more expensive phone lines continue to increase.

The Logiphone Group (Ra'ananna, Israel, +972 9 914360) has won the race to announce the first global Internet fax service that doesn't require users to have an Internet connection. Using PassaFax hardware developed by RadLinx (Tel Aviv, Israel, http://www.radlinx.rad.co.il), Logiphone is establishing a worldwide network that will eventually encompass 40 countries. PassaFax clients will pay \$35 a month, plus local phone charges to connect to the Logiphone access number, to send international faxes.

Subscribers attach a PassaFax autodialer to their fax machine or computer and send faxes as usual. Local faxes are transmitted over regular telephone lines, but long-distance and international faxes are automatically routed to a local Internet service provider (ISP).

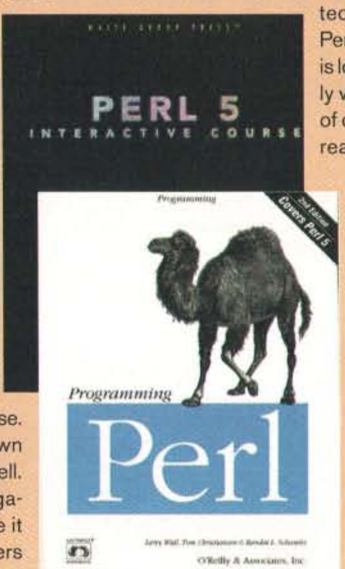
From there, PassaFax hardware sends the message over the Internet to the PassaFax-equipped remote ISP in the destination city, where the data is converted back to a fax. The destination number is encapsulated in the header of the IP transmission. During the IP handshake between the two PassaFaxes, the destination number is transferred and analyzed to remove international dialing codes and turn the transmission into a local call. The fax is then forwarded over regular phone lines, for which the user is also billed.

Logiphone's rivals are allying with ISPs in many countries so they can offer Internet faxing to subscribers. I-Fax, launched in May by Arel (Yavne, Israel, http://www.arel.co.il), and IP/FaxRouter, from Brooktrout Technology (Needham, MA, http://www.brooktrout.com/), launched in June, both operate in a way similar to RadLinx's PassaFax's. I-Fax and IP/FaxRouter combine routing hardware with management software that monitors usage and—for ISPs—generates client-billing invoices. Arel has signed an agree-

Book Reviews

Perls of Wisdom

Although Perl 5, the much-evolved version of the ubiquitous scripting language, has been available for over two years, books about it are scarce. Up to now, if you wanted to use Perl 5's new advanced features, including compound structures, object-oriented abilities, dynamically linked modules and extensions, and improved variable scoping, you had to grovel through Perl 5's technical documentation with your Perl 4 book also open by your side.



Two books that now help fill this void are *Perl 5 Interactive Course*, by Jon Orwant, and *Programming Perl–Second Edition*, by Wall, Christiansen, and Schwartz. These two books are radically different in style.

Each of the 14 chapters in Orwant's book has eight "sessions," each one ending in a four-question multiple-choice quiz and an exercise. Each chapter has its own quiz and exercises as well. This book is rigidly organized. The author wrote it for the reader who prefers to learn in a classroom rather than in a lab or in the real world. He assumes the reader has little or no programming experience, yet he covers even the advanced features of dynamic linking, C functions and libraries as extensions to Perl, and Perl as an extension to C programs.

Orwant knows his material: He uses Perl in his work at MIT's Media Lab and is the editor of the *Perl Journal*. But the book's weaknesses (i.e., the approach that favors classroom lessons over real-world ones) are due to the restrictions, planning, and editing inflicted by the publisher.

Like other books by O'Reilly & Associates, *Programming Perl–2nd Edition* features an engraving of an animal on its cover. The definitive reference to the Perl 4 programming language is affectionately known as the "Camel Book." The second edition, although its content and list of authors are considerably expanded from the first edition, still sports an image of a camel on the cover.

The new edition includes revisions to the first one, plus it adds almost 200 pages that cover Perl 5. The new edition is reorganized appropriately for Perl 5, which is itself a total rewrite and reorganization of Perl 4 that maintains almost perfect backward compatibility.

The primary author of *Programming Perl–2nd Edition* is also the primary architect and programmer of Perl, Larry Wall. His writing is loaded with a refreshingly wry humor and a sense of companionship with his readers. Wall's coauthor Tom Christiansen has been lecturing about and teaching Perl since its early days; when Perl 5 arrived, he was the bard of its new ability to do compound structures and dereferencing of variables. Randal L. Schwartz, who contributed much of the work in putting together the first edition, also assisted with the editing and management of this edition.

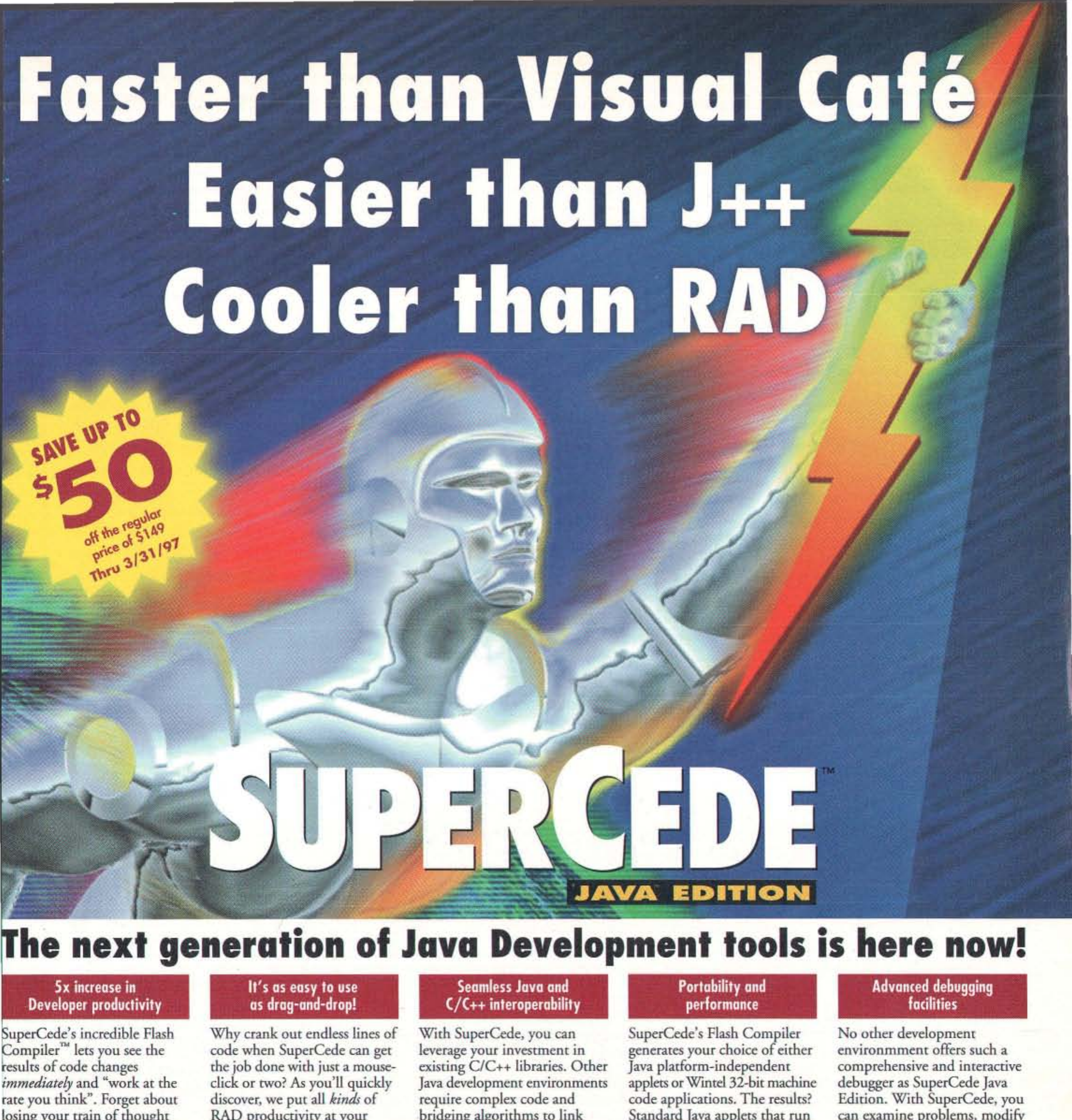
The Perl 5 distribution comes with a considerable amount of documentation in the clever form of Perl Online Documentation (POD), a code-embeddable markup language that you can use to generate Hypertext Markup Language (HTML), PostScript, and plain-text output. From now on, POD will be the definitive documentation for Perl, since it's updated with new revisions and additions to Perl. The second-edition Camel Book merges these documents with the first-edition text and also adds a welcome dose of humor and organization, as well as examples.

The only fault with this book is that the examples may be too clever for the average Perl programmer. Otherwise, the Camel Book reigns again as the definitive text on Perl.

–Ben Smith

Perl 5 Interactive Course
by Jon Orwant; Waite Group Press;
ISBN 1-57169-064-6;
\$49.99

Programming Perl–2nd Edition
by Larry Wall, Tom Christiansen, and Randal L. Schwartz; O'Reilly & Associates;
ISBN 1-56592-149-6; \$39.95



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ment with EUNet, one of the largest pan-European ISPs, and has installations in the U.S. and the U.K. Brooktrout is initially focusing on intracompany faxing.

For those who don't want—or need—to use a fax machine, several companies offer Windows-based software solutions to cut your phone bills. FaxStorm Desktop, from NetCentric (Cambridge, MA, http://www.netcentric.com/), and Internet Fax Exchange, from NetXchange Communications (Migdal Ha'Emeq, Israel, http://www.ntxc.com), were both launched in 1996. In October, Open Port (Chicago, IL, http://www.openport.com) announced Harmony ISP. All three products, which remain transparent to the user, allow corporations to exploit their Internet connections.

NetCentric's FaxStorm is based on the company's POPware technology, software that runs at the point of presence (POP), where phone line meets Internet connection at the ISP's operations center. From the desktop, FaxStorm compresses, encrypts, and transmits faxes to a POPware server, which routes the fax over the Internet to the POPware server closest to its final destination.

NetCentric has allied with Concentric Network Corp., a U.S.-based ISP covering both the U.S. and Canada that has offered an Internet faxing service since last August.

Similarly, NetXchange has developed a simple fax-transport protocol, called SFTP, that lets a company's network servers manage faxes by acting like switches. The company's Internet Xchange for Fax software determines the most cost-effective delivery route—via telephone lines, private LANs, or the Internet.

The newest version, specifically tailored to the ISP, has already been acquired by ISPs and telecommunications firms in several countries. AimQuest, a consortium of worldwide ISPs and telecommunications companies covering the U.S., Europe, and the Far East, is to establish a global fax network for its members using NetXchange's technology.

Open Port's Harmony also incorporates a least-cost routing facility for corporate faxing, and the company offers Harmony ISP to ISPs. At press time, no information was available as to how many ISPs were using Open Port's technology, but a company spokesperson said to expect an announcement this year.

The success of these various solutions will depend in part on their ability to attract a large global network of ISPs so that users aren't limited in the number of destinations they can send faxes to. Choosing from among the various options offered depends on your particular circumstances, either as a business user or a home user. The good news is that a wealth of solutions are emerging to lower your telephone bill. **–Tania Hershman**

Datapro Report

Better Backbones to Shoulder Bigger Network Burden

Developments in the Internet service provider (ISP) marketplace will continue to unfold at a lightning pace over the next year. The activities of major service providers have centered around four areas: expanding the geographic reach of ISPs' Internet backbones, upgrading backbone capacity, delivering enhanced levels of service performance, and adding new services, including Web-site design, Web hosting, and content creation.

Better backbones are already needed. Meanwhile, demand for bandwidth might increase as on-line services, such as America Online, Prodigy, and Microsoft Network offer flat-pricing schemes (see the table below).

A snapshot of activities in 1996 and proposed activities for 1997 highlight how the major ISPs are positioning themselves to offer value-added services for businesses:

Concert. At first, this was an international joint venture between Washington, D.C.–based MCI and London-based British Telecommunications (BT) to offer virtual network services. But MCI and BT will now merge and form a new company called Concert plc. Plans include expansion of the companies' Internet networks to include 20 Internet superhubs around the world. Concert will provide ISPs, telecommunications carriers, and businesses with Internet/intranet transport and access services on an international basis.

Pacific Bell/IBM Global Network. IBM (Armonk, NY) will install high-speed links between its international backbone and the network of Pacific Bell (San Francisco).

Cable & Wireless. This Vienna, Virginia–based interexchange carrier will add Web services, such as home-page design and hosting services, to NetWorth, the company's Internet product package, and expand its number of network-access points worldwide.

Internet Thruway. Northern Telecom (Raleigh, NC) is working to transfer data and Internet connections of long duration from the traditional voice network to a packet-/cell-switched data network. Thruway consists of adjunct switches that work with a telephone central office to alleviate the strain of Internet traffic on the public-switched telephone network.

On-Line Service Charges

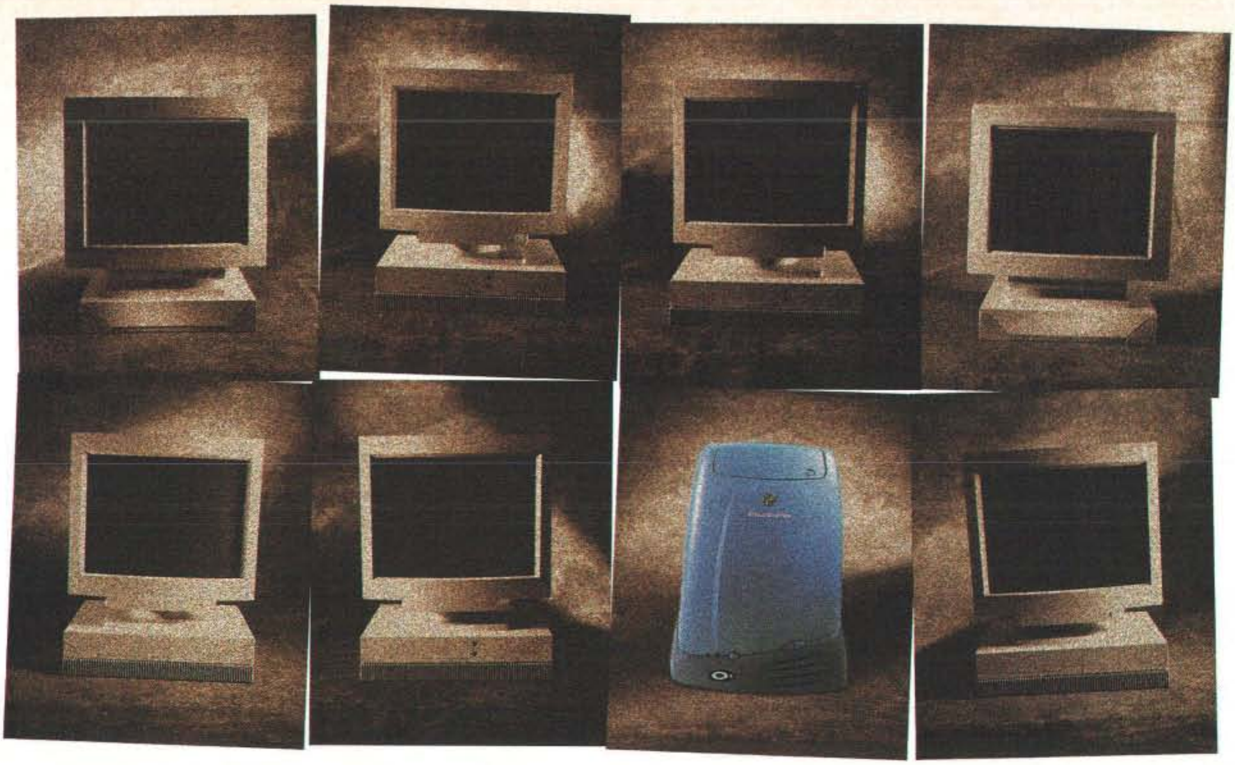
Consumer time on-line should increase due to flat pricing schemes.

Service	Initial cost per month	Additional hours	Free trial period
America Online	$19.95 (unlimited)	Does not apply	15 hours; $2.95 for additional hours
CompuServe	$9.95 for 5 hours $24.95 for 20 hours	$2.95 per hour $1.95 per hour	10 hours; $2.95 for additional hours
Microsoft Network	$6.95 for 5 hours $19.95 (unlimited)	$2.50 per hour Does not apply	30 days
Prodigy	$19.95 (unlimited)	Does not apply	First month

Diamond.Net. The St. Louis–based Diamond.Net is constructing a private, managed fiber-optic and satellite network using asynchronous transfer mode (ATM) and SONET/SDH technology to accommodate the demands of a new generation of network services.

MFS, UUNET, and the World. MFS (Omaha, NE) had barely finished announcing that it would acquire UUNET when it revealed plans to merge with WorldCom (Jackson, MS). The plan for MFS and UUNET was to leverage MFS's extensive fiber facilities with UUNET's line of Internet products and services to offer businesses a range of Internet-access services. Now, with the addition of WorldCom, the combined company will offer local, long-distance, and Internet services.

Michael Smith *is lead analyst, network services, at the Datapro Information Services Group. For more information about the full report, call (609) 764-0100 or contact http://www.datapro.com.*



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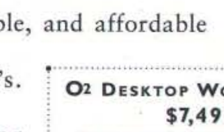

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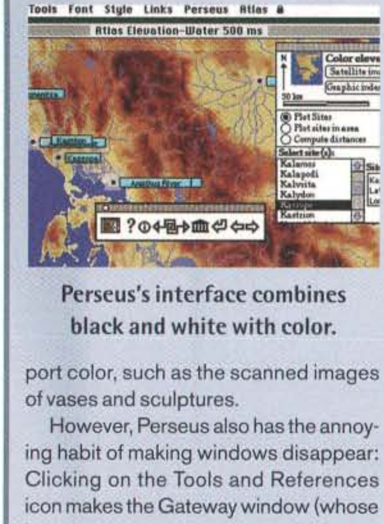
cd-rom review

Ode to a Grecian Disc

Perseus 2.0, an industrial-strength interactive guide to ancient Greek culture—from its archaic period to the era of Alexander the Great—lives up to its title of Comprehensive Edition. The CD-ROM offers four discs, containing 25,000 images of vases, sculpture, architecture, and sites. It also contains a hypertext chronological history, an encyclopedia of historical and mythological characters and places, the complete works of 31 ancient Greek authors (displayed in both English and Greek), and other resources. By using the included maps, encyclopedia, and history references, you can completely immerse yourself in the era.

But while you shouldn't judge a CD solely by its interface, Perseus's leaves you with a poor impression of the work. The encyclopedia, along with most of the navigational aids, collected texts, and catalogs, and are in black and white. Fortunately, other parts of the CD-ROM support color, such as the scanned images of vases and sculptures.



Perseus's interface combines black and white with color.

However, Perseus also has the annoying habit of making windows disappear: Clicking on the Tools and References icon makes the Gateway window (whose icons steer you to texts, maps, and other source material) vanish, making it difficult to pick up information from the encyclopedia and use it to locate a passage in the text. Persesus offers a treasure trove of information, but its clumsy interface makes you feel like Indiana Jones on a dig, looking for clues among the rubble.

–Tom Thompson

Perseus 2.0, Yale University Press,
New Haven, CT, (203) 432-0960;
fax: (203) 432-0948
Comprehensive Edition, $350;
Concise Edition, $150

Advances and Retreats in Computing

The Security of Imaginary Numbers

The government's paranormal R&D efforts have resulted in a commercial spin-off. Get ready for a truly foolproof data-security protocol called PGP-Y, which stands for Pretty Good Parapsychology.

The mechanism is simple. You imagine that you've transmitted data to someone; that person then imagines that he or she has received that data. Using PGP-Y, any type of information can be transmitted over the Internet with complete security.

The key is that the data is transmitted high over the network—so high that it actually travels above the network. The data is also transmitted telepathically. For those who mistrust electronic funds, there's also a scheme for transmitting cash and gold plate telekinetically, but that won't be commercialized until sometime in the future.

Net Abuse: Announcing Project Whacko

On some days, the surge of unsolicited junk mail inflicted on e-mail users everywhere seems to reach epic proportions. Some of it comes from banditos who use fake sending addresses that are difficult to trace. Inspired by such incidents, we announce the creation of Project Whacko, an ongoing research effort to induce electronic junk mailers to whack themselves out of existence. We will publish and disseminate the best techniques users come up with.

Here are the principles of Project Whacko:

1) The goal of Project Whacko is to prune the population of indiscriminate junk-mailers.

2) Project Whacko schemes will use judo/jujitsu principles to redirect the evil actions of electronic-junk-mailers back to the putrid perpetrators.

3) Project Whacko schemes will themselves never involve the sending of indiscriminate electronic junk mail.

Please send your responsible Project Whacko scheme to marca@improb.com.

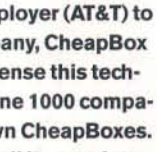
Coming: Superfast, Cheap Boxes

Parallelized network computers based on obsolete hardware will change the way you compute while saving you money. The genius of the Internet CheapBox is that it takes piles of obsolete computers—everything from 8088 machines to Mac Centrises—and, through the magic of parallel processing, converts them into attractive, inexpensive, 5- by 5- by 5-foot jet-black Internet CheapBox cubes that run Java applets with 100 to 300 times the power of a Pentium PC.

CheapBox inventor Jarrod Charron has left his nominal employer (AT&T) to form a consulting company, CheapBox Enterprises, that will license this technology and assist Fortune 1000 companies in building their own CheapBoxes. The company plans to sell its own Internet CheapBox for about $350 through CompUSA, Sears, and Staples. Tests of a preliminary beta version of the CheapBox 2000 show that the device lives up to its hype and is likely to significantly crimp sales of the low-cost, stripped-down workstations that traditional workstation vendors are currently planning.

Plugged Professionals

Occasionally seen posted in newsgroups: inquiries from computer professionals who want to be "plugged into" the job market. The problem is a lack of standards. There are no generally accepted plug specifications or cabling standards. If your organization has found or developed a proven set of standards, please get in touch with me.



Marc Abrahams is the editor of the Annals of Improbable Research. *You can reach him at* **marca@improb.com.**

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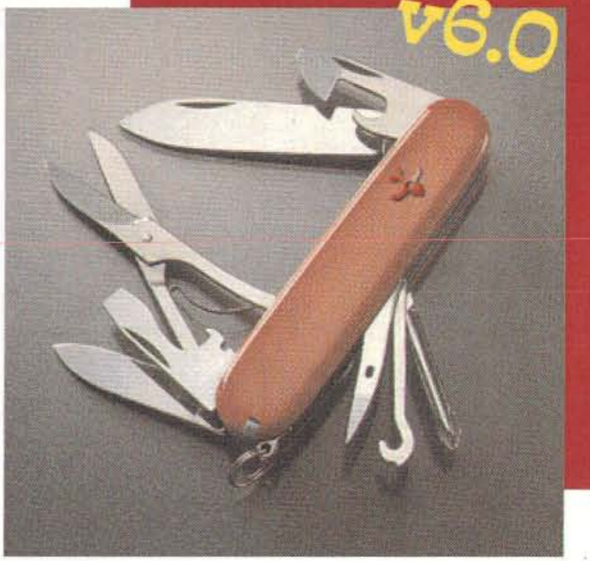

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Blasts from the Past

5 Years ago in BYTE

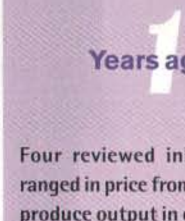
We reviewed the first multimedia PCs, but MPC then referred mostly to CD-ROM and audio. But cooler things were on the way. In the same issue, we described Apple's new QuickTime, which ushered in the age of video to Macs and PCs. The U.S. and China were again feuding over intellectual property rights and software.

10 Years ago in BYTE

Four reviewed ink-jet printers, which ranged in price from $479 to $1795, could produce output in only seven colors. Their speed was measured in minutes per page. Compaq's Deskpro 386, with 1 MB of RAM, a floppy drive, and a 40-MB hard drive, cost $6499. The lightest portable reviewed in this issue weighed 10 pounds.

15 Years ago in BYTE

BYTE published several articles about using computers to do your taxes. Steve Ciarcia's project of the month was on how to construct a computerized weather station. Ads for Commodore Computers featured William Shatner, of Star Trek fame.



20 Years ago in BYTE

BYTE offered articles about using digital cassettes for mass storage, build-it-yourself computer-navigation systems, and Fairchild Semiconductor's F8 processor.

Lessons Learned in the Data Mine

Alan Paller, director of research at the Data Warehousing Institute, tells how to avoid the pits in your data-spelunking adventure.

BYTE: *What are the most common problems and solutions in a successful data-warehouse implementation?*

Paller: One of the more difficult problems, especially in a large data warehouse, is getting the various divisions of a corporation to arrive at a common set of definitions for data—for objects such as sales, customers, and products. Take an insurance company, for example. It has a property-and-casualty division, and it probably has a health-and-life division. Those divisions have completely different kinds of products. So the data it keeps for the products is completely different from one division to the other.

Defining what exactly is the "customer" becomes difficult. Is the customer a company, or is the customer an individual? Or is the customer that piece of building you're insuring? There are good reasons for the differences in definitions, and there's no easy solution to how you create a corporate-wide common set of data definitions.

The answer to the question of how you deal with that problem is not a fun one, but it's the simplest one anyone has ever found: You agree to disagree, and you build separate data marts for each of the divisions. Then you find the few things that are common, like payables or receivables—organizations that you owe money to or collect money from—and you make corporate-wide databases with those. You get an added bonus when you identify common suppliers: You can draw all your purchasing together to get one of the most important and profitable benefits of a data warehouse, which is being able to show your vendors all that you're buying from them, which lets you get better discount rates.

BYTE: *What's another common gotcha, and how can you overcome it?*

Paller: One of my favorites is when a pair or group of vendors says, "Our products will work well together." It's quite common to hear from a vendor that it has a strategic alliance with another vendor and that the products will work together. Well, many times they don't.

So, the only time you get a strategic alliance that's viable is when it's client-driven—when a customer says, "I'll buy these two products only if they work well together and if and only if you agree to make the interface between the products part of your product." But the customer has to be mighty big to persuade a company to do this. You should also make the vendors prove that their products work well together and guarantee in writing that they'll continue to work together for at least three years.

BYTE: *What are other caveats for customers who have already rolled out their data warehouses?*

Paller: As soon as data warehouses become worthwhile, important people depend on them. And so all the things that you have to do for a big business system become important. You have to have security that's real, scheduling to automatically update it and verify the update, and backup and recovery. The amount of money that people are spending on that part of data warehousing will grow probably to 50 percent of all investment in data warehousing. Most people don't budget for this, but they should.

For more information on the Data Warehousing Institute, send e-mail to **tdwi@aol.com.**

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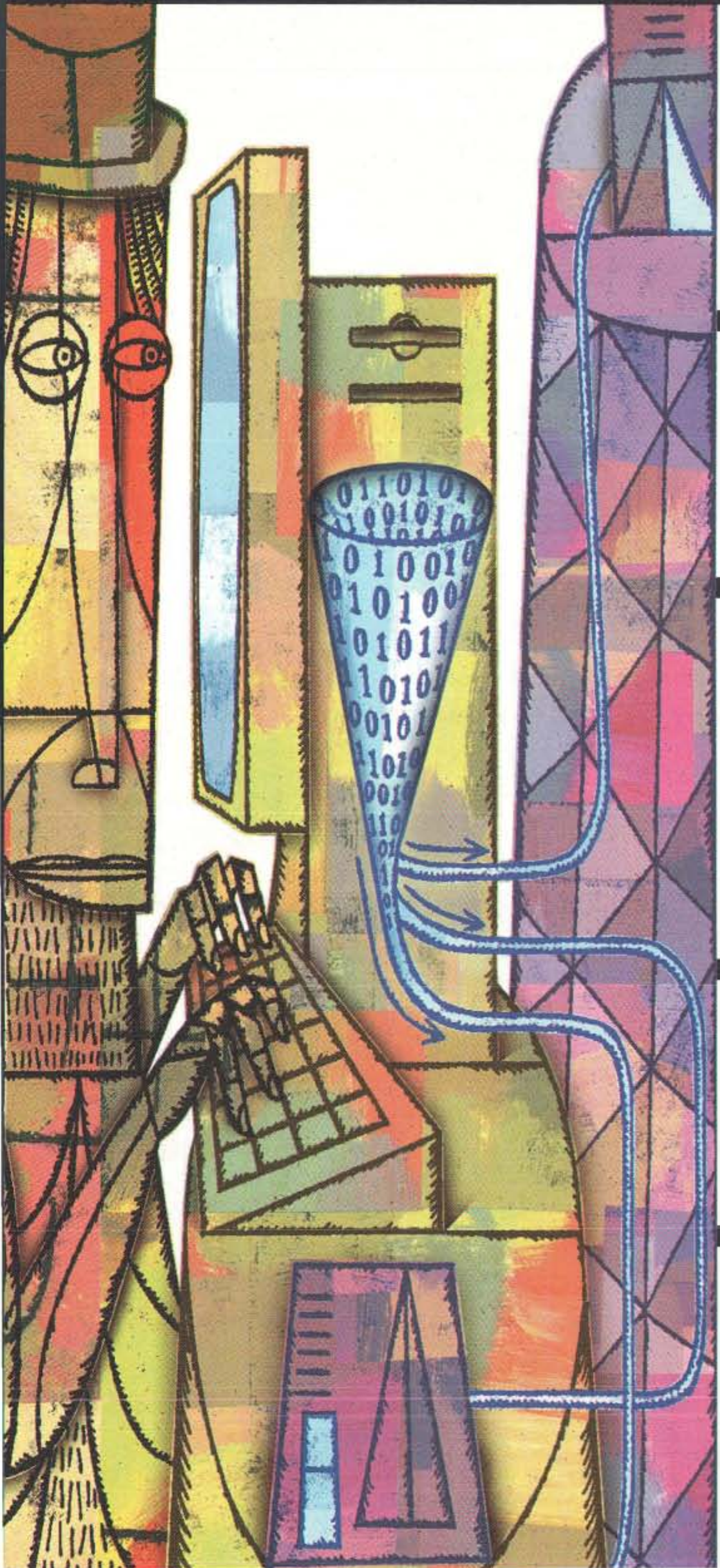


BYTE GITEX 96 Awards

Recognizing the best Arabic products and technologies.
Page 40IS 3

USB's Slow Start

Increased cost is a factor.
Page 40IS 6

Manage Massive Web Sites

SuperFast Editor makes the Internet a friendlier place.
Page 40IS 6

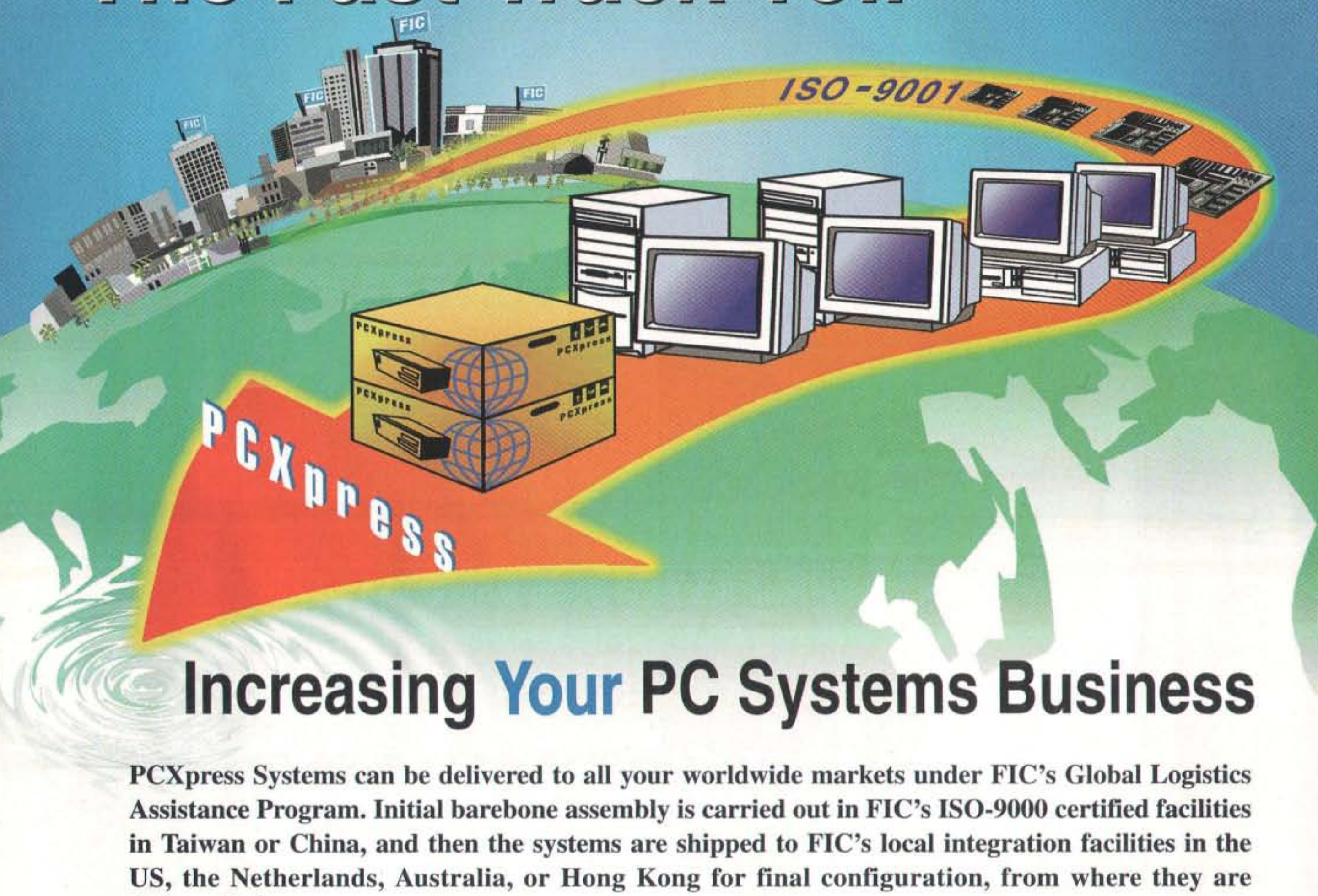
In the Line of Fibre

Fibre Channel products arrive.
Page 40IS 11

Network Performance

The cost-versus-performance conundrum. Page 40IS 17

The Fast Track To..



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BYTE Middle East Announces Best of GITEX 96 Awards

New Arabic technologies garner most of the prizes.

DUBAI—New Arabic technologies, including innovative Arabic/English translation products, were the stars of the show at GITEX 96 (The Gulf Information Technology Exhibition). More than 61,000 information technology business users attended this year, an 89 percent increase over last year, according to Nidal Abou Zaki of the Dubai World Trade Center. There were 400 exhibitors from 29 countries.

BYTE Middle East, the Arabic edition of BYTE magazine, recognized the best Arabic technologies and products with its Best of GITEX 96 awards. The top show award for Best Arabic Technology went to two products: the Arabic Automatic Diacritiser, from Sakhr Software (Cairo, Egypt; +202 274 9929; fax: +202 274 0044, http://www.sakhr.com; sakhr@sakhr.rite.com), and the Transphere Multilingual Machine Translation System, from Applications Technologies (McLean, VA, U.S.; +1 703 821 5000; fax: +1 703 734 5703; myaghi@apptek.com).

Written Arabic contains diacritical marks, and the meaning of a word differs greatly according to its diacritics. Sakhr's product is the first Arabic automated diacritiser; it provides the needed infrastructure to build a powerful syntax/semantics analyzer, which is needed to produce an accurate Arabic/English, English/Arabic translation product. The Transphere Multilingual Machine utilizes the knowledge of modern computational linguistics theories to translate Arabic into English and vice versa.

The award for Best Innovative Arabic Technology went to Arabic Textware (Amman, Jordan; +9626 834606; fax: +9626 836735; arabtext@go.com.jo) for its Arabic Pen. This technology enables the recognition of Arabic cursive handwriting. The other winning technology is Arabic SX, from Arabic Digital Agencies (Yemen; +9671 267675; fax: +9671 267676; apple@y.net.ye). Arabic SX does phonetic searches of bilingual Arabic/English databases.

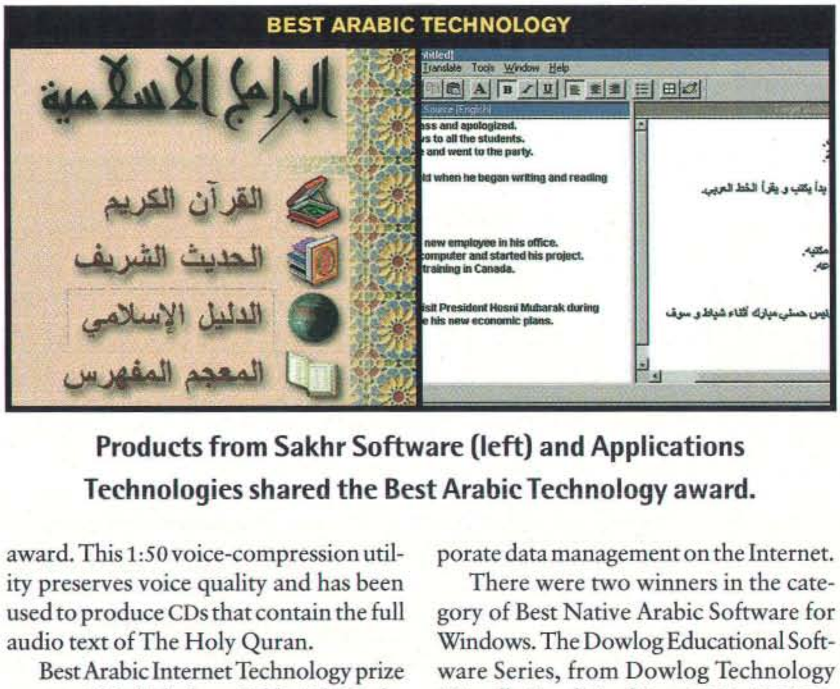
The Voice Compression Utility, from Research & Development International (Cairo, Egypt; +202 3499378; rdi@ritsec1.com.eg), received the Best International Arabic-Developed Technology award. This 1:50 voice-compression utility preserves voice quality and has been used to produce CDs that contain the full audio text of The Holy Quran.

Best Arabic Internet Technology prize went to Al Bahith, from Sakhr. This is the first morphology-based Arabic search engine for the Internet, where the amount of Arabic content is growing. Al Bahith enables the building of Internet and intranet search engines.

Sindbad, also from Sakhr Software, received the Best Arabic Internet Software award. This add-on lets different browsers, such as Netscape Navigator and Microsoft Explorer, handle browsing, e-mail, and chatting in Arabic, in addition to adding strong features such as spelling checking and dictionary-based translation of words in Web pages.

The Best Arabicized Internet Application was Arabic InterOffice, from Oracle Middle East (Dubai, U.A.E.; +9714 313828; fax: +9714 313258; hdajani@ae.oracle.com). It is currently the only Arabic application that enables smart corporate data management on the Internet.

BEST ARABIC TECHNOLOGY



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بدأ يكتب و يقرأ الخط العربي.

يس حسني مبارك أثناء شباط و سوف

Products from Sakhr Software (left) and Applications Technologies shared the Best Arabic Technology award.

There were two winners in the category of Best Native Arabic Software for Windows. The Dowlog Educational Software Series, from Dowlog Technology (Riyadh, Saudi Arabia; +9661 4625566; fax: +9661 4623356; http://www.dowlog.com), excels in presenting learning materials for young students. The other winner was Arabic for Non-Arabs, an instructional CD-ROM from Sakhr Software.

Best Native Macintosh Arabic Software was Alef, from Zeine Technological Applications (Amman, Jordan; +9626 618851; fax: +9626 618852; zeineops@go

Newspad Makes El Periódico Interactive

A group of readers of *El Periódico de Catalunya*, Barcelona's largest newspaper, can now browse, personalize, and structure their own newspaper on a tablet-like computer called Newspad. The easy-to-use device automatically updates news content overnight by encrypted broadcast transmissions such as Direct Video Broadcast satellite.

Newspad, developed by Acorn Risc Technologies (Cambridge, U.K.), is built around Acorn's 32-bit Arm7500 processor. It has no controls other than an on/off switch. Thanks to a touchscreen overlay, users can browse contents and navigate information paths with their finger. Newspad can handle full-motion video and 16-bit audio besides traditional newspaper graphics and text. The principal applications running on the device are Macromedia Director Player and Hypertext Markup Language (HTML) interpreters.

Acorn's Newspad: The future of electronic newspapers?

Content can also be transferred via the Internet, using a one-way protocol (in contrast to the bidirectional protocols HTTP, FTP, or Gopher). System designers from Acorn say that in future Newspad could also carry a small FM receiver to collect trickle-feed updates, such as traffic flashes, localized news, weather reports, and advertising. A personalized filter downloads only the kinds of material that the user has specified. **–Jim Nagel**

.com.jo). This is a powerful, easy-to-use native multilingual word processor with the ability to read the Arabic Windows text format. The other winner in this category, Oryx, from Linotype-Hell (Nicosia, Cyprus; +572 333842; fax: +572 333845), is the first world-class Arabic desktop publishing package to hit the market.

Best Arabicized Software awards were granted to Arabic Windows 95 and Arabic Office 95, from Microsoft (Dubai, U.A.E.; +9714 513888; fax: +9714 527444, ahmedc@microsoft.com). Other products awarded in this category were OS/2 Warp for the Arabic User 4.0, from IBM (Cairo, Egypt; +202 3492533; fax: +202 3601227; Direct@eg.ibm.com), and Arabic Corel Draw 6.0, from Corel (Ottawa, Ontario, Canada; +1 613 728 0826; fax: +1 613 7619179; 74143.3424@compuserve.com).

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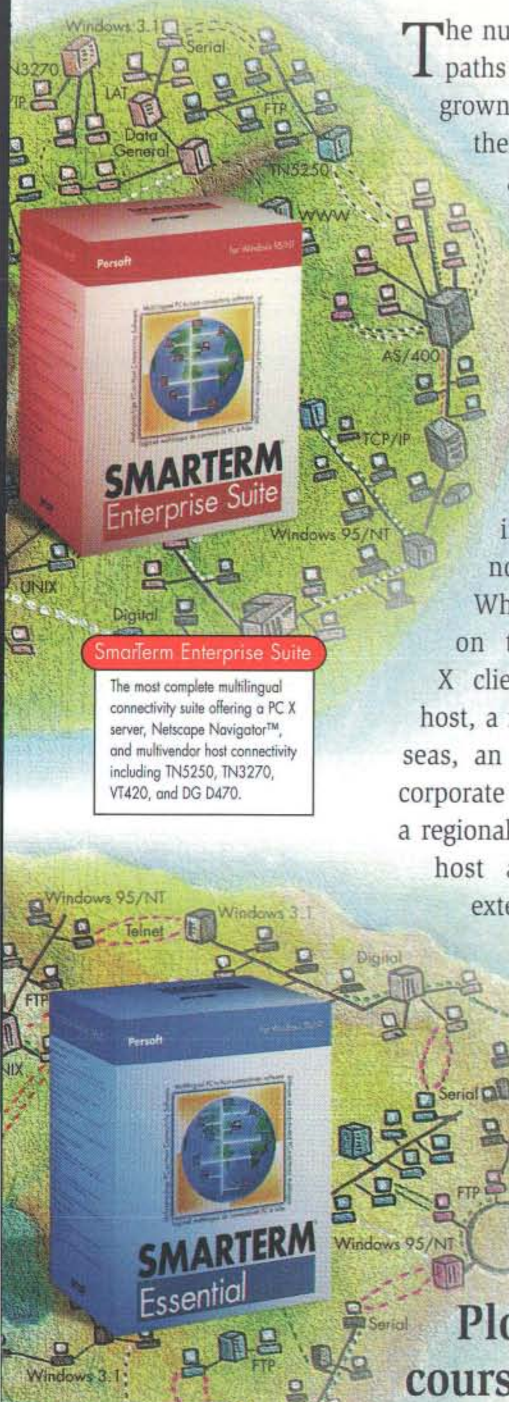

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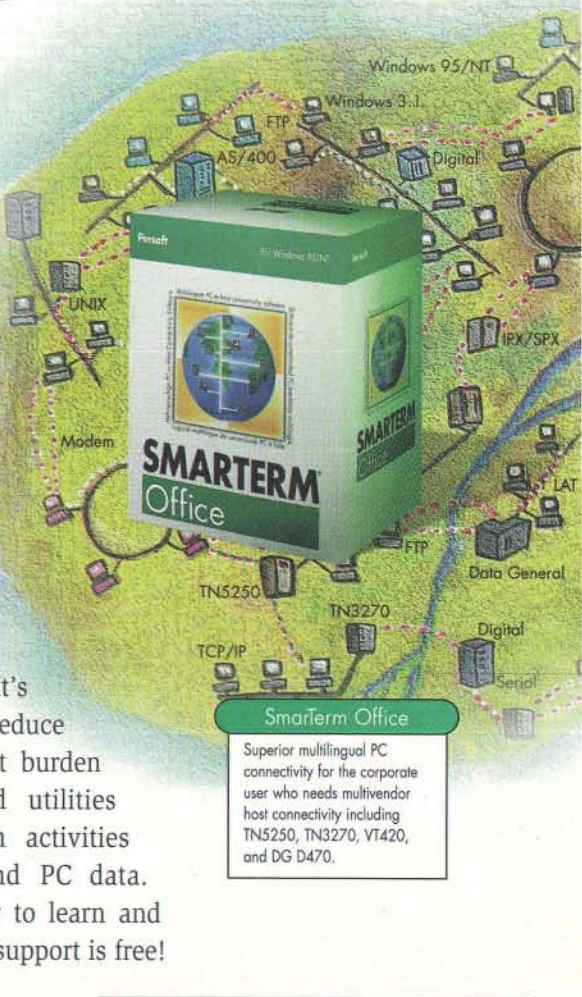

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Circle 714 on Inquiry Card.

USB Trickles to Market

The Universal Serial Bus (USB) is entering the mainstream PC market, albeit slowly. The new peripheral communications standard was widely accepted late in 1995. Then Intel put its muscle behind the technology with its current Pentium-level chip sets and peripheral chip. Now, a Taiwanese vendor is also offering a USB chip.

VIA Technologies' PCI-to-USB controller, the VT83C572, is designed to be integrated onto either an add-on card or a non-USB-capable mainboard. Key features of the new controller include USB 1.0 compatibility as well as Universal Host Controller Interface (UHCI) compatibility for a data transfer rate of 12 Mbps. Legacy support for keyboards and PS/2 mice is also provided. The product life of this chip is likely to be rather short since new Pentium and Pentium Pro core logic chip sets support USB. USB controllers for peripheral devices are another story, however.

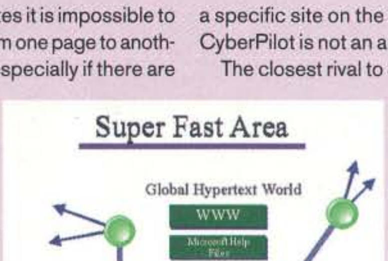
Last February, Intel introduced its 82930A USB peripheral controller, the first USB peripheral chip. It complies with all the USB specifications except one, a very important one: According to an Intel spokesman, this first chip does not support the daisy chaining of peripherals. The ability to hook up all of a PC's peripherals to one bus is one of the main features of USB. This chip's price—$6 per unit in lots of 10,000—is also a barrier.

VIA plans to release a USB peripheral chip in the second quarter. "There's a market for USB peripheral controllers, but it seems to be developing slowly," said VIA president Chen Wen-chi. VIA's USB controller will definitely support daisy-chaining capabilities, Chen said.

Most Taiwanese peripheral vendors state that they support USB but also mention concerns regarding controller costs. For mice and keyboard manufacturers, whose products retail for $5 to $20, a $6 component is an unlikely possibility. Monitor, scanner, and printer manufacturers have more leeway in absorbing an additional $6 component cost. Monitor manufacturers are, however, designing their USB products as end-use devices. This means they are intended to be the last device on a USB chain and hence don't need a hub controller chip. Some are shipping their USB monitors without even USB cabling, leaving that up to system integrators. Whether USB will take off this year could depend on getting controller costs down. **–Mark Carroll**

Check All the Links

Within most Web sites it is impossible to divine the path from one page to another several clicks away–especially if there are thousands of pages. What's needed is a road map. HyperMed's SuperFast (SF) Editor automatically creates a map of a whole site, organizing it into a hierarchical structure within which each section, page, and paragraph is precisely located for swift retrieval and manipulation. At all times, the site author or a visiting surfer knows where they are in the hierarchy and has the option of backtracking or descending deeper into the site.



HyperMed's SuperFast Editor maps and watches links to a Web site.

The HyperMed program keeps an eye on all links and warns of removed pages or connections that should exist. It also copes with multiple parenting–when a page is linked to more than one location–without unnecessary duplication.

Webmapping is the latest trend for hassle-free surfing, but finding this feature in an authoring tool is rare. Web editing software such as Microsoft's FrontPage and Netscape Navigator Gold offer some measure of mapping but do not structure the site hierarchically to the extent necessary for the building of massive sites. NetCarta's CyberPilot will enter and map a specific site on the Web for the surfer, but CyberPilot is not an authoring tool.

The closest rival to SF Editor is NetCarta's WebMapper, a Web authoring tool that also creates a hierarchical map of a site. However, WebMapper is not a full authoring tool; it displays a map of all links but shows only file names, so authors cannot automatically change the information within the site.

SF Editor was not originally developed for Web design. Two years ago, HyperMed found no package suitable for publishing its Pediatrics CD-ROM, which is composed of hundreds of thousands of pages and an average of 20 hypertext links per page. So the company went ahead and developed its own authoring tool. When the time came to create a similar-size Web site, the further application of SF Editor became obvious.

However, software that deals with a site in such minute detail is perhaps an unnecessarily sophisticated tool for designing most current sites, which tend to be 50 rather than 50,000 pages. Instead, as a site grows and spirals out of control, SF Editor may be employed as mapper and manager, helping to restore order to chaos.

–Tania Hershman

WHERE TO FIND

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CD-ROM Near Speed Limit?

There are limits to how fast CD-ROM drives can get using the standard constant linear velocity (CLV) disk-reading technique. "Above 12x speed, there are problems with vibration and excessive heat," said Eric Tseng of Acer. But "the new CAV [constant angular velocity] system will allow manufacturers to move to 16x and 20x speeds."

William Wang of Acer Peripheral concurs and adds that an additional concern is the cost of such high-speed motors. Wang and Tseng agree, though, that in the first quarter of this year such drives will be the norm at the high end. As far as a final speed limit for later in 1997, the answer is unclear. "Our experts view that 20x is the limit to speed for CD-ROM drives due to motor mechanical constraints," said Eve Kwek of Wearnes Peripherals.

After CD-ROM drives, digital videodisc (DVD) drives could be huge market opportunities for manufacturers in Taiwan and

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Singapore. Acer is currently sampling DVD drives; production volumes are expected for the second half of '97. Wearnes is also set to begin DVD production. "By the end of Q1 '97 we will be sampling, with production by Q2 '97," Kwek said. But other Taiwanese and Singapore manufacturers aren't quite so sure about DVD. "The market demand is uncertain," said Tseng at Acer. "There are some basic marketing as well as cost problems with the product." Lack of software may initially stifle customer demand, Tseng added. Software vendors (i.e., Hollywood) are hesitant to release the 1000 to 5000 titles necessary to drive demand until copyright problems are resolved.

A DVD speed war is also a possibility. Richard Green, marketing manager of Adaptec, said, "DVD should not have x [speed] ratings. X rating is sort of seen as a cheap marketing trick without much end-user benefit or technology behind it." Felix Nemirovsky, engineering manager at Plextor, agrees. But when asked if DVD manufacturers will use speed as a marketing tool, he said, "There's no way in hell they will not." **–Mark Carroll**

MHEG Complements Interactive TV

Hypertext Markup Language (HTML), Java, and the Web are taking the world of interactive applications by storm. But there are areas where these technologies fall short.

A couple of international multimedia content producers and set-top box manufacturers–Philips Business Electronics, Sony, and Nokia among them–are currently evaluating the new ISO standard 13522-5 for multimedia distribution. Called Multimedia and Hypermedia Information Coding Expert Group (MHEG), it is a self-contained hypermedia architecture that can run in environments with very small resources, such as set-top boxes where Java-enabled browsers are an overload. Although it was originally developed for broadcast applications, MHEG has some substantial advantages for information and point-of-sales terminals as well as interactive TV.

Testers report that, in contrast to HTML, MHEG relieves the server load because it transmits complete scene information only once to the client. It employs an object-oriented model, generic enough to format different kinds of multimedia documents, and provides on any network the quality of service people expect from TV. In addition, it offers powerful models of spatial and temporal synchronization between different media, which are not provided for in other standards.

For developers of interactive TV the quality of service that MHEG offers is the main issue. "Failure is not an option. Here you cannot tolerate GUI crashes or unresolved references," said an engineer at Philips Business Electronics (Eindhoven, The Netherlands).

Currently, there are two mature authoring tools for MHEG-5. One, based on Asymetrix's ToolBook, was developed by DeTeBerkom (Berlin) and Grundig Multimedia Solutions (Nuremberg, Germany). The other uses Macromedia's Director and was designed by CCETT, France Telecom's R&D institute.

Several companies and research institutes have developed MHEG run-time engines. The Digital Audio Video Council (DAVIC) has chosen MHEG as the standard exchange format for high-level applications. In the DAVIC specification 1.1, MHEG coexists with Java and can be called from within an HTML document.

–Valerie Thompson

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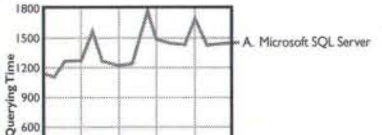

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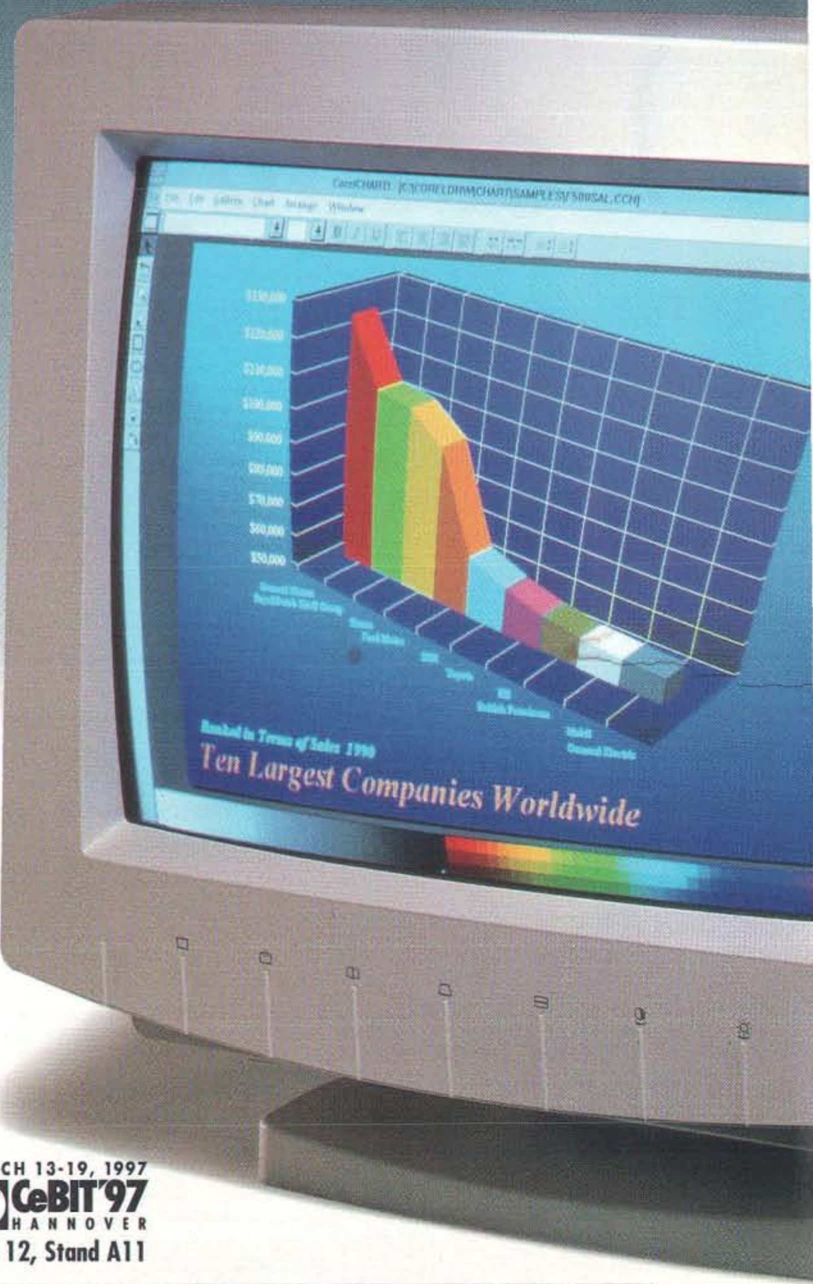
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M1450	14"/0.28	30-50KHz	50-90Hz	1024x768	digital	speaker
M1558	15"/0.28	30-56KHz	50-90Hz	1024x768	analog	
M1565	15"/0.28	30-69KHz	50-90Hz	1280x1024	digital	speaker
M1568	15"/0.28	30-69KHz	50-90Hz	1280x1024	digital OSD	
M1764	17"/0.39	30-69KHz	50-90Hz	1024x768	digital	speaker
M1765	17"/0.28	30-69KHz	50-90Hz	1280x1024	digital OSD	speaker
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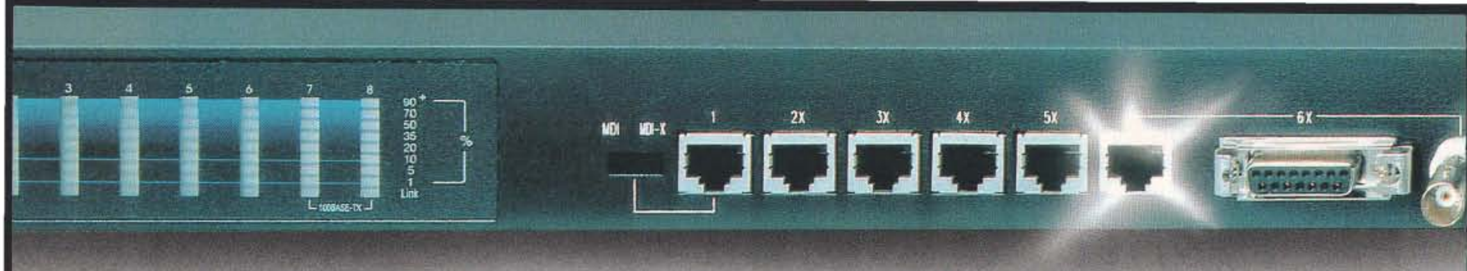

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In the Line of Fibre

Mass storage and image processing demand high throughput. Fibre Channel technology delivers it.

By Otto Lehner

Finally, the first products that capitalize on the Fibre Channel–Arbitrated Loop (FC-AL) architecture are on their way to market. At next month's CeBIT in Hannover, Germany, you can expect to see new FC-AL peripherals from several manufacturers.

For many of today's data storage systems, SCSI—the standard for fast and reliable data transmission for years—is no longer appropriate. The reasons are not just throughput bottlenecks but also cable distance limitations of existing technologies. For a high-end RAID level 5 server system, for example, you need a minimum of three independent channels with a cabling length of at least 3 meters. With SCSI, or even with Wide and Ultra SCSI's maximum cable lengths of 3 and 1.5 meters, respectively, this is hardly possible.

ILLUSTRATION: RICHARD DOWNS © 1997

The same problem is prevalent in the local networking area. Ethernet provides a reach of a few hundred meters. Above that limit, connections become flaky. The Fibre Channel architecture aims at eliminating throughput and distance limitations for both peripherals and LAN infrastructures.

The basic concept of a transparent high-end connection technology that encapsulates already established and proven transfer protocols has been around for several years (see "Fibre Channel: Fast and Flexible," May 1996 BYTE). One of the most distinctive features of the Fibre Channel is compatibility with existing software. Unlike SCSI and asynchronous transfer mode (ATM), the Fibre Channel protocol does not have its own command set, but simply manages the data transfer from port to port and thus interoperates with existing upper- level protocols (ULPs).

To achieve the very high transfer speeds of up to 1 Gbps and to avoid a time-consuming protocol management in software, Fibre Channel's data flow control needs to be laid out in hardware. The serial standard transfer rate of 1 Gbps is 10 to 250 times higher than that of other connection technologies. R&D groups are investigating even higher transfer speeds (2 and 4 Gbps). At the same time Fibre Channel technology has a lower latency and allows for cable lengths of up to 10 kilometers. The high transfer speeds are an essential advantage for RAID applications that need fast and parallel access to multiple mass storage devices.

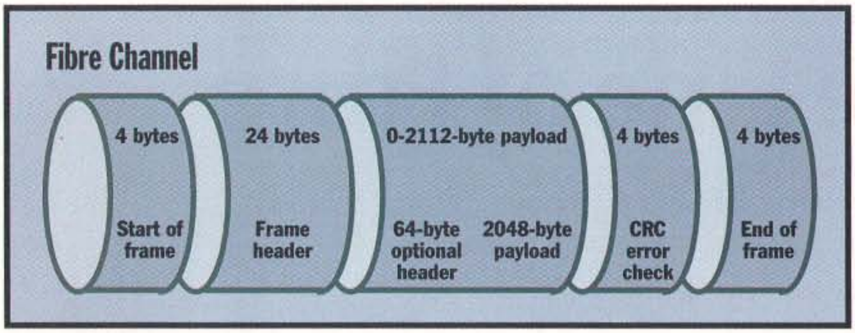
Though the word suggests it, Fibre Channel technology is not limited to fiberoptic media. (Different spellings help distinguish between the connection technology and the transfer media: fiber for the former, fibre for the latter.)

Besides the transfer speed and protocol characteristics, topology plays an important role simply because it determines the number of simultaneous connections as well as the available bandwidth. The Fibre Channel supports three connection topologies with different complexities: Point-to-Point, Arbitrated Loop, and Cross-Switched Fabric. The three topologies can be combined, providing for easier upgrades of existing systems.

To connect two devices or to incorporate a single system into an existing configuration, the simplest topology is a Point-to-Point connection. In contrast to SCSI, Fibre Channel Point-to-Point configurations have no termination problems.

The Arbitrated Loop (FC-AL) topology is capable of connecting up to 126 participants in a closed loop. The address of an FC-AL device can be set by hardware, software, or automatically by its position in the loop. The system then transfers data and control commands simultaneously on both parts of the loop.

The Cross-Switched Fabric (FC-XS) topology is based on a switched matrix architecture similar to a telephone network. It



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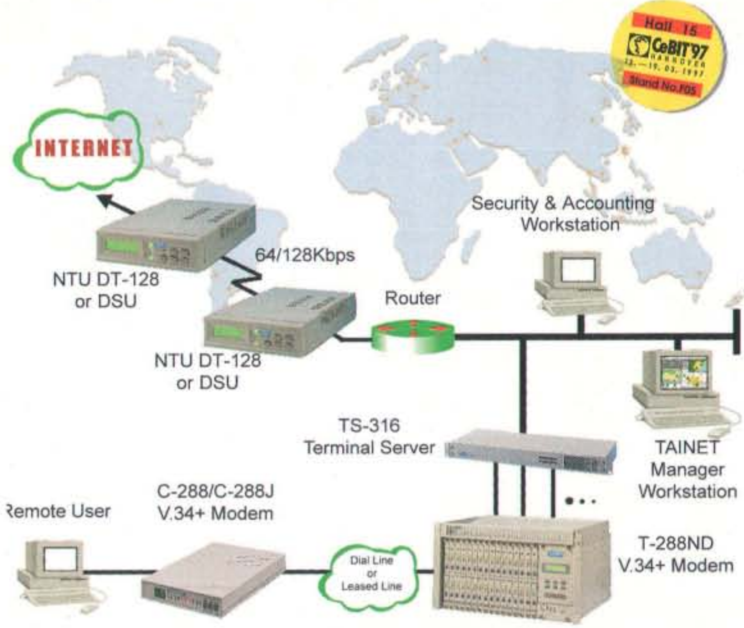

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is a connection-oriented architecture that allows several participants to utilize simultaneously the full bandwidth. In addition, it establishes a network that automatically bypasses failed nodes, thus providing higher reliability. The 24-bit addressing system of a fabric supports more than 16 million network nodes, so address space is not a problem.

The hardware and the Fibre Channel protocol handle the routing of the data packets as well as transfer errors, which eliminates extensive station management at the nodes. It is very easy to connect FC-XS peripheral devices to LANs.

A Class of Its Own

The Fibre Channel supports five different service classes either unidirectionally or bidirectionally. All devices are allowed to define the service classes, which isn't the case with other protocols. In addition, it is possible to use different service classes simultaneously.

Class 1 establishes a dedicated circuit-switched connection, granting full bandwidth for all participants. This service class guarantees high data transfer rates in combination with low latency, but it uses the connections exclusively and is not able to free up bandwidth for other connections. This method is useful if large amounts of data have to be transmitted from one point to another very quickly.

Class 2 provides connectionless data transfer with verification and acknowledgment services. It routes data packets individually, as in an Ethernet or Token Ring LAN, and lets packets share the same bandwidth.

Class 3 services are similar to class 2, but they have no means of packet verification and acknowledgment. Because of its lower delays, class 3 is particularly suitable for audio and video applications. This service class also applies if ULPs such as SCSI perform data verification. It is also possible to "intermix," using temporarily available bandwidth of a class 1 connection for class 2 and 3 data packets transmission, improving the overall net throughput.

Class 4 provides a simultaneous exchange of data packets between two participants in a network by utilizing several routes so that bandwidth is guaranteed. This service class is particularly beneficial in a fabric where the load changes continuously but connections must have a minimum data transfer rate. In this case,

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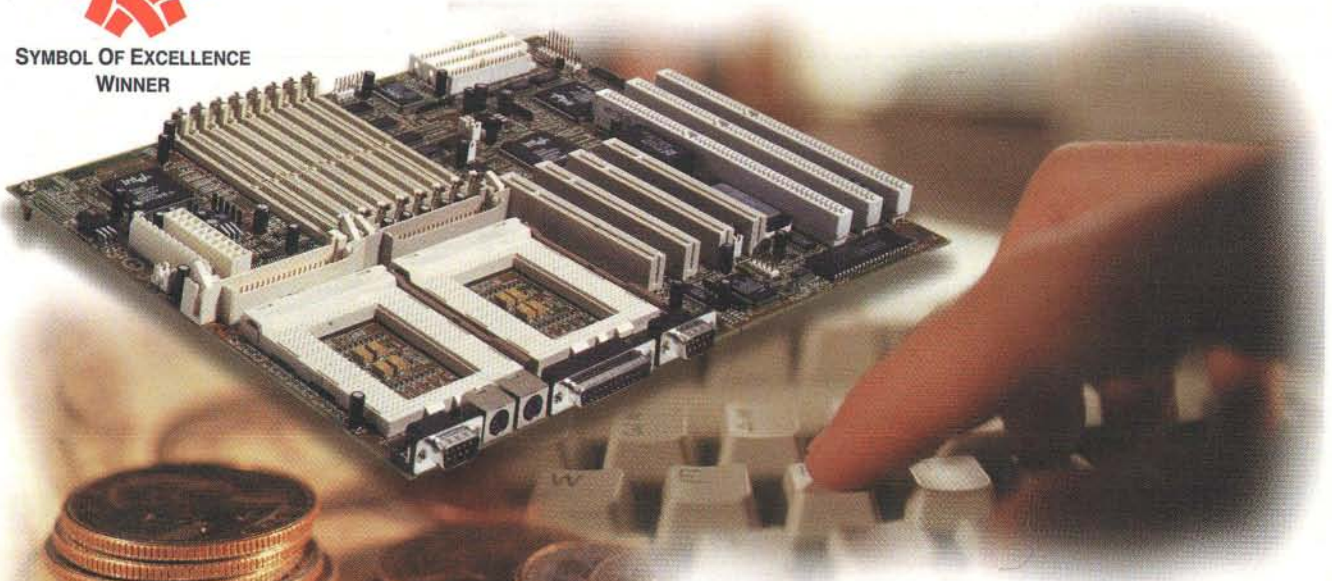

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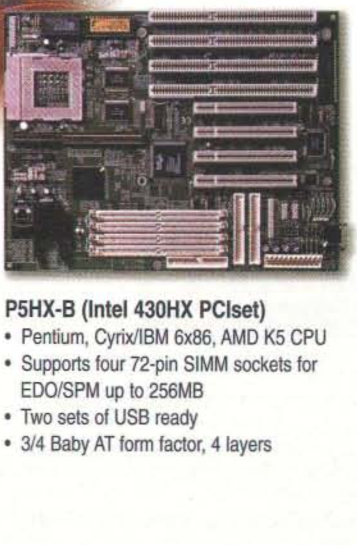

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the remaining bandwidth can be used by other applications.

Class 5 service allows for simultaneous (isochronous) data transfer to several participants and is especially applicable for audio and video servers in broadcast mode.

Except for class 1, all classes require a fabric network. Class 4 and 5 specifications are not yet fully fleshed out.

A Layered Architecture

Encapsulation of the existing transfer protocols, the so-called ULPs, and support of the different physical transfer media made it necessary to separate the Fibre Channel protocol into five layers, FC-0 to FC-4.

FC-4 links the Fibre Channel architecture to the ULPs and maps ULP data packets to a data buffer. The FC-2 layer then assigns these sequences to FC transfer packets (frames). This way, different ULPs can be transferred simultaneously.

FC-4 specifications have been finalized for the peripheral protocols HIPPI, IPI-3, SBCCS, and SCSI and the networking protocols IP, IEEE 802 (Ethernet and Token Ring), and ATM. The number of supported ULPs will grow in the near future and will soon include memory buses like VME or Futurebus+.

The frames assembled by FC-2 functions consist of an obligatory administration part and a variable-size payload area of 0 to 2112 bytes (see the figure on page 40IS 12). The frame headers contain routing and transfer information. The 4-byte cyclic redundancy check (CRC) code at the end of each frame helps detect transmission errors.

Another substantial part of the FC-2 layer functions is data-flow control for both fabric- (class 1) and frame-controlled (class 2) data transfers. For class 2 services, the FC-2 layer reassembles the original transfer sequence, even if the frames are routed through different connections and arrive out of order. The FC-2 protocol also is responsible for acknowledgment and automatic reconnection of transfers. The FC-3 layer has not yet been specified completely. It will define common service function for groups of networking participants (hunt groups).

FC-1 controls and synchronizes serial data transfer. It uses an 8-/10-bit encoding scheme that combines 8 data bits with 2 additional bits so that the resulting 10 bits have, on average, as many high bits as low bits (50 percent signal balance). This offset-free transmission assures a high signal quality. Even if fast transfer rates are combined with long distances, it guarantees a low bit-error rate. The trade-off is, of course, that 25 percent more data has to be transferred, which necessitates higher transfer rates. To avoid confusion about the real transfer rates, the Fibre Channel community uses MBps for the net transfer rate and Mbps for the overall transfer rate. Thus, the Fibre Channel's standard net transfer rate of 100 MBps is equivalent to a total of 1 Gbps.

The lowest protocol layer, FC-0, is the physical link module. It defines the physical interface characteristics, including connectors, cables, speed, transmitters, and receivers. The Fibre Channel supports single-mode and multimode fiber optics and coaxial and twisted-pair cables.

FC-AL Architecture

Almost all the products coming up this year will use the FC-AL architecture for two reasons: The specification of the more complex fabric will not happen soon, and the gigabaud link modules (GLMs) that couple different FC-AL transmission media are still very expensive. These develop-

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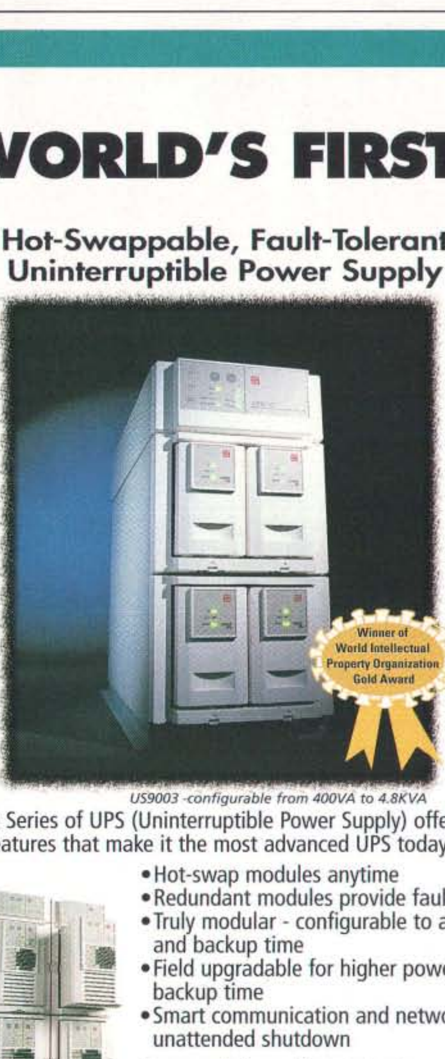

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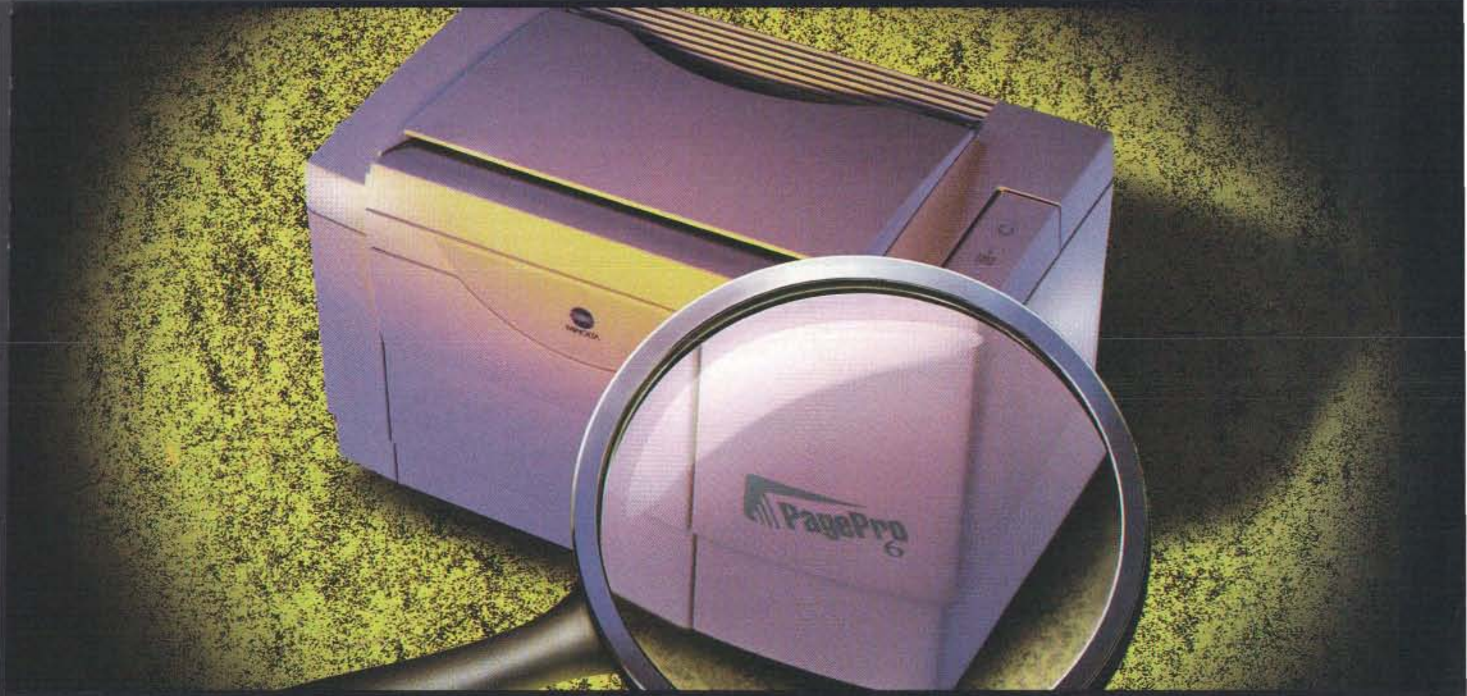

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mental limitations restrict Fibre Channel technology for now to high-performance connections between peripherals.

For the same reasons, mass storage systems in arbitrated loop topology that employ the SCSI protocol will play a predominant role in the near term. For larger RAID systems, the use of multiport devices in parallel loops will prevail.

Parallel FC-AL loops enhance redundancy as well as performance. If a RAID controller and a hard disk array connect in two parallel loops, two independent paths are available for data transfer, almost doubling data transfer rates.

Fibre Channel has significant advantages such as high reliability, fault tolerance, real-time transmission, and flexibility of services. The goal of the Fibre Channel community is a network of corporate servers, workstations, and peripherals connected in one large chain. **B**

Otto Lehner is a software engineer and firmware specialist with ICP Vortex Computersysteme (Flein, Germany). You can reach him by sending e-mail to **lehner@vortex.de.**

How Fibre Channel Compares

Although IBM's Serial Storage Architecture (SSA) aims only at data storage, it compares with the Fibre Channel–Arbitrated Loop (FC-AL) in terms of topologies, the maximum number of participants, and cable lengths. SSA's transfer rates vary between 20 and 80 MBps. As an upper-level protocol (ULP), it uses almost exclusively the SCSI protocol.

Compared to the parallel SCSI bus, the Fibre Channel's advantages are higher transfer rates, higher cabling lengths, and lower costs. Parallel SCSI is currently limited to 40 MBps (16-bit Wide or Fast 20 SCSI). Although there are concepts to expand the SCSI bus to 32-bit (Wide 32) and to double the transfer speed to 40 MHz (Fast 40), resulting in a total 160-MBps transfer rate, it is still not clear whether it is technically feasible. However, since parallel SCSI is extremely popular and widespread, it will continue to play an important role. The use of SCSI as a ULP in other technologies is an indicator of its continuing importance.

The local network technology FDDI was designed for multimedia data transmission via optical fiber similar to the FC-AL. Although its transfer rate of 12.5 MBps is lower than that of the FC-AL, it has proven to be sufficient for high-quality audio and video delivery on backbones. The big advantage of FDDI is its synchronous data transfer mode. The serial-bus standard IEEE-1394-FireWire also has a maximum transfer rate of 12.5 MBps but allows isochronous multimedia transfer. It is restricted in cable lengths.

ATM's transfer rate is 19.4 MBps (155 Mbps). Because of the relatively small size of the data packets (53 bytes) and the high portion of the administration and control information of up to 10 percent in one cell, ATM is not appropriate for the connection of peripherals. Fibre Channel, however, with its payload of up to 2112 bytes per frame is optimized for PC applications with typical block sizes of 512 bytes.

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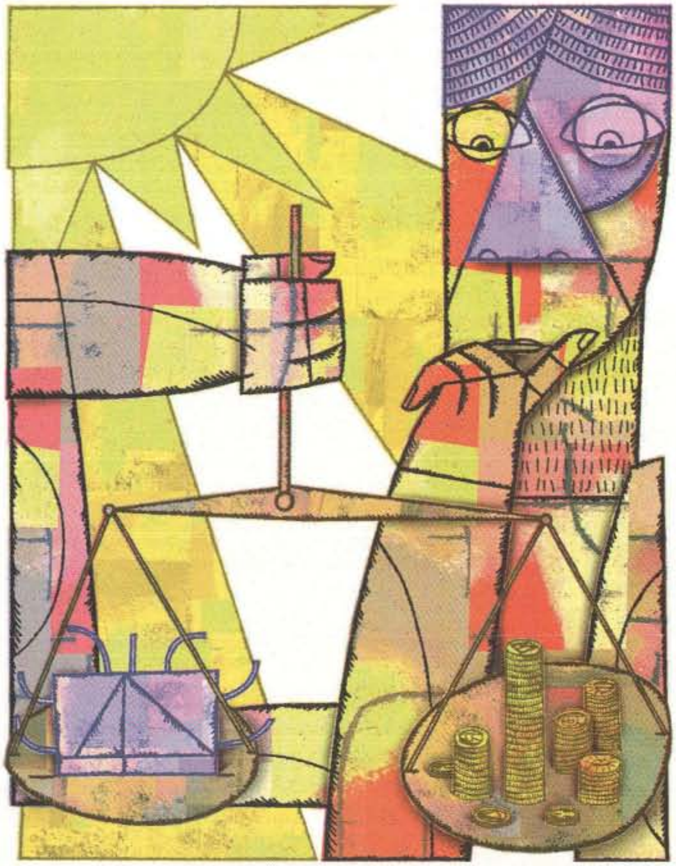
The Cost/Performance Network Shuffle

Mixed 10-/100-Mbps hubs and switching hubs will be this year's big product area for Taiwan's network makers.

By Mark Carroll

Wall Street may be enamored of the latest technology from U.S. network companies, but is it wise to advise your boss to invest in an asynchronous transfer mode (ATM) or 1-Gb network? The Taiwanese suggest that if you want to keep your job, perhaps you should focus your attention on the more tried and true technologies. They've done very well by offering network equipment that, while not sexy or leading edge, does offer proven, standardized technology that won't break your budget and won't become the network equivalent of the eight-track cassette player.

The Taiwanese networking companies specialize in low-cost, mature products that conform to known standards and have wide market acceptance. An example of how the Taiwanese wait until a new technology has been refined and standardized is Fast Ethernet hubs and switching hubs—technology that adds value, but at a price that's mainstream.



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Fast Ethernet

Fast Ethernet transfers data at 100 Mbps (or 100,000 bits per second), 10 times the rate of standard Ethernet. Until early 1996, there were two different competing Fast Ethernet technologies on the market, TX and VG.

While VG is still available, primarily from Hewlett-Packard, TX is now recognized as the preferred standard. This is true even though VG has some technology advantages over TX, namely, no collisions and no dropped packets. What is on the market, though, shows that TX has won out; even HP is now making TX products. The reason for TX's success is twofold. One is that Fast Ethernet TX switches allow for flow control. According to Henry Ngai, customer service vice president for network products manufacturer D-Link, flow control allows the switching hub to send data until told not to by the receiver. The hub then switches to the next node, thus eliminating collisions and lost packets. The other reason is a marketing one. VG is a variation of the proprietary Token Ring technology. Ken Lu, R&D vice president for the network company Accton Technology, thinks that "VG is no good because nobody wants to follow a proprietary standard." The network market, like the information-technology (IT) market in general, is loath to support any kind of proprietary solution, for obvious reasons.

10-/100-Mbps Hubs

This year, mixed 10-/100-Mbps hubs and switching hubs will be the so-called cutting-edge product area for Taiwan's network makers. Various Taiwanese manufacturers have had Fast Ethernet hubs for more than two years, though sales have been limited. This year, though, all manufacturers agree that such products will have wide market acceptance because of the favorable cost/performance ratio they offer.

It's been widely written that Fast Ethernet provides 10 times the performance at only twice the price. If this were true, the buyer's choice would be obvious. The 100-Mbps adapter cards run at about that cost differential but hubs and switches are still about six times the cost of a similar Ethernet product.

On the high-end, high-bandwidth front, most Taiwanese network manufacturers now offer pure, multiport 100-Mbps Ethernet hubs and switching hubs. D-Link offers an eight-port design. CNet and Network Peripherals, Inc. (NPI) both offer 12-port pure

100-Mbps Ethernet hubs and switching hubs. These products are expensive, however, and their popularity is limited to engineering workgroups or large LANs that have multiple enterprise servers. The Fast Ethernet hub services the enterprise servers and serves as their link to most of the network. It also acts as a dedicated 100-Mbps hub for heavy data users that need large throughput capability for activities such as sharing graphics files.

Mixed Speeds

All the Taiwanese firms offer the mixed-speed feature in their 100-Mbps hubs and switching hubs. Commonly called N-way, this feature allows the controller to autosense what a node can handle and to send data at either 100 or 10 Mbps. Again, though, this is an expensive solution for addressing mixed-speed environments. As a result, the Taiwanese have a large array of mixed 10-/100-Mbps hubs and switching hubs.

Few users need a total 100-Mbps network since most don't regularly handle extremely large files. Most networks, however, can see a marked performance improvement with mixed 10-/100-Mbps hubs and switching hubs. Prices for these products will in fact soon reach the magical "times-two" price of standard Ethernet. This makes these products especially attractive in Europe, where running fiber-optic cable between buildings is more common than in the U.S. For areas where fiber-optic cabling is not widespread, 100 Mbps could be a problem. Fast Ethernet can support distances up to 2 kilometers if fiber-optic cabling is used. Without fiber, category 5 unshielded-twisted-pair (UTP) cable is needed.

This is also known as "data quality" cable. The effective distance between hubs using UTP is only 200 meters using duplexing. Duplexing in networks is analogous to that in standard phone lines. The effect for the user is a doubling of bandwidth.

Reduced Chip Counts

One reason why mixed 10/100 hubs are coming down in price is the appearance of reduced chip count solutions for these products from many vendors. Basic network hub chip design calls for three types of chips: a controller chip, transceiver chips, and a physical (PHY) layer chip. Previous designs from Taiwan used a variety of mixed-chip solutions. Some were even as costly as one transceiver and controller chip per port. Several of the larger Taiwanese network manufacturers save money by having their own 10/100 hub and switching hub chips developed.

D-Link's Ngai says, "We'll have a one-chip solution for a 2x100-Mb/12x10-Mb hub in the first quarter." Dik McLellan, product marketing manager at CNet Technology, agrees. He said, "In the first quarter, there will be single-chip solutions for mixed 10/100 hubs and switches." A few Taiwanese IC design houses also offer network chips, but they don't agree that one-chip solutions will be coming to market anytime soon, at least at the switching-hub level.

Mark Huang, president of Tamarack Microelectronics, says that "UTP transceiver chips still need to be done with a BiCMOS process. CMOS process yields are still only around 20 percent. There is a learning curve, however, so eventually yields will get better." Huang also said that Ethernet switching hub chips are a long way from moving to a single-chip from the present three-chip solution. He believes it won't happen until "we can move to 0.35-micron process fabrication with increased yields. If someone did have a

ATM's Slow Acceptance

Although the Taiwanese believe that 1-Gb technology will push back the acceptance of asynchronous transfer mode (ATM), they are cautiously beginning to offer ATM products. D-Link is not very interested in ATM, considering it an expensive WAN interface and more of a telecommunications product than a networking product.

Ken Lu at Accton said that they will have a sample ATM backbone out at the end of the year. "For large customers, it is a good solution as a WAN backbone," he says. "ATM has some interoperability problems, though. It will take us several months to test the compatibility of our new ATM product with those from Digital, Cisco, etc." Network Peripherals is also working on an ATM product.

Adam Horng, sales manager for Network Peripherals, says, "We will roll out a LAN/WAN ATM product in Japan in the first quarter of 1997. It will have a 64K/155K speed that can run over standard phone lines."

CNet is the farthest along in developing and manufacturing ATM products. Since mid-1996 it has offered an ATM/Ethernet hub. At that time, it provided this hub as an integral part of a pilot ATM project at the Hsinchu Science Based Industrial Park (SBIP), located outside Taipei.

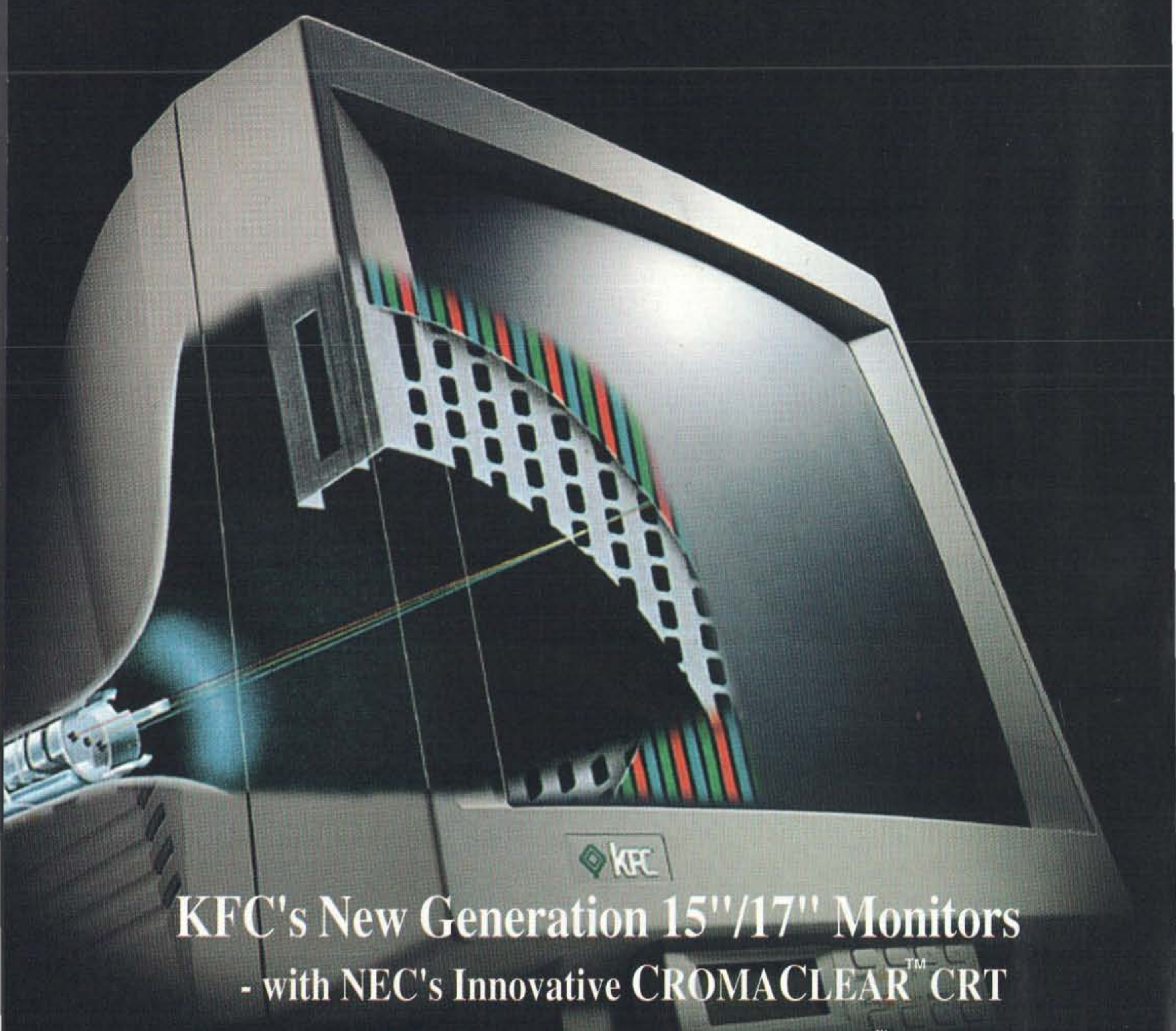
Over a dozen of these hubs are located at the phone company's local switching office. About 100 companies at SBIP as well as Chiao Tung and Tsing Hua universities (two of Taiwan's top engineering schools) have nodes. The WAN is connected with a fiber-optic telephone cable link that has been installed in the park. Information travels across this link at 155 Mbps using an OC-3 interface. (OC-3 stands for Optical Carrier; the "3" denotes three times the speed of the base 51.6-Mbps rate.)

The CN9100 is an eight-port 10 Mbps-to-ATM switching hub with a transparent asynchronous transceiver/receiver interface (TAXI). The TAXI transfers data from the ATM interface to the Ethernet interface at 100 Mbps. The eight 10-Mbps ports provide a 10-Mbps switched Ethernet interface using 15-pin attachment unit interface (AUI) connectors. Each switched port creates a separate network segment, guaranteeing dedicated bandwidth to attached devices.

Contained within the chassis of the CN9100 are four modules: CPU, ATM, Ethernet master, and Ethernet slave. This modular design allows for easy troubleshooting and field service. The CPU module contains most of the hub intelligence and serial, parallel, and configuration ports. The ATM module has the Management Integration Consortium (MIC) connector for the TAXI. The two Ethernet modules, master and slave, hold the eight Ethernet ports.

Used as a LAN-WAN interface, the CN9100 dedicates 10 Mbps to each Ethernet port, with local port-to-port switching performed at a wire speed of 14,880 packets per second. ATM is supported via a configurable permanent virtual circuit (PVC) and a user network interface (UNI).

Currently, CNet is marketing these hubs to two types of clients. Phone companies will use them in a way similar to that of the SBIP project. The phone company will buy the backbones, and lease their use to companies that want high-speed WAN ATM access but don't need or can't afford the cost of their own systems. The other marketing channel is made up of large organizations that have several LANs in place. These customers want to keep the LANs in touch while still having a convenient 100-Mbps "big pipe" available for videoconferencing or large database transfers.



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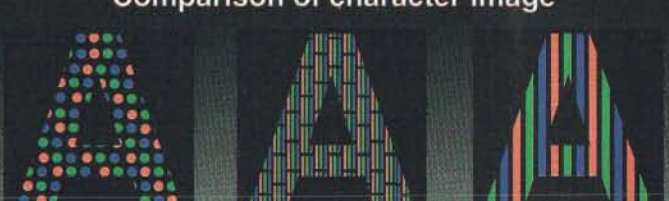
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Circle 724 on Inquiry Card (RESELLERS: 725).

Later This Year: 1-Gb Ethernet Switches

An Ethernet network transferring data at 1 Gbps is the Ethernet vendor's answer to ATM technology. Dik McLellan at CNet said, "Ethernet people don't want ATM to happen, so 1 Gb is their move to keep ATM on the back burner."

The 1-Gb Ethernet products began to appear in the U.S. in late 1996, all using proprietary technologies. We should see standard protocols for 1-Gb networking equipment by midyear. As a result of the lack of a standard, the Taiwanese are waiting to introduce 1-Gb switches, but most agree that 1 Gb has potential for late this year, though volumes will be low. Some manufacturers see problems in commercially implementing 1-Gb products, notwithstanding 1 Gb's use of the same technology as Ethernet and Fast Ethernet. For the Taiwanese, 1-Gb technology is mostly a fancy tweaking of standard Ethernet technology. Mark Huang, of Tamarack Micro-Electronics, says, "Basically, 1-Gb Ethernet uses the same technology as 100-Mb, but at a higher frequency. This heightens the problem of collisions. As a result, every node needs a switch. You can't use standard hub designs." Lu at Accton adds that the technology "not only increases the signal frequency but also splits data into three channels from the one channel used by 10- or 100-Mb Ethernet." Cabling is another potential problem with 1 Gb. Current designs call for either the use of four-pair, category 5 unshielded twisted pair (UTP) or fiber-optic cabling. Ken Lu at Accton disagrees, however, thinking that fiber-optic cable is the only way to go.

The problem of increased cabling costs pales in comparison to basic flaws in 1-Gb technology. Due to the high speed of packet transfer, collision detection greatly reduces the effective transfer distance of 1-Gb Ethernet. McLellan says that because of the need for collision control, 1-Gb Ethernet is limited to a distance of 10 meters, or 20 meters duplexed. Henry Ngai at D-Link concurs but sees a potential way around this distance limit in a move back to VG technology. He says, "If you go to 1 Gb, VG technology begins to get attractive again. That's because you don't need a switch and you can go farther than the 20-meter limit."

Even if the distance barrier is overcome, however, most Taiwanese doubt the basic need for 1-Gb. Their question is one of total system data flow. Officials at D-Link, CNet, Accton, and Tamarack all say that at 1 Gb you get CPU and software bottlenecks in the total system. McLellan says, "Even at 100 Mb, the network is not the bottleneck. System constraints are. Current systems certainly can't match 1-Gb-level bandwidth." Ngai concurs, pointing out that at 10 Mbps you get 1000 packets per second with interrupts. At 100 Mbps you have 10,000. At 1 Gb you have 100,000 packets per second with interrupts, which is more than any current or planned CPU or software can handle. Ngai doubts the mainstream need for 1 Gb. "Since most traffic in a network is intradepartmental," he says, "1 Gb is not really cost-effective. A better solution is a 12-port 100-Mb switching hub."

Speed and Reach

	Packets per second	Effective distance
10 Mb	1000	1 K
100 Mb	10,000	100 m
1 Gb	100,000	10 m

Most Taiwanese agree that 1 Gb will not be mainstream until 1998, but most still plan to offer some type of 1-Gb product this year. Accton, in particular, will offer a mixed 100-Mb/1-Gb switch at the end this year. As is usual in the PC market, though, the Taiwanese suggest caution when buying first-edition products.

single-chip solution, though, they would make a lot of money."

Switching Hubs

Switching hubs are important for large networks for two reasons: They overcome TX's problem with collisions, and they offer an advantage over standard 100-Mbps hubs by partitioning an overloaded network. When a packet is forwarded to another node in the same segment, the switch confines traffic to that segment. If a packet is sent to a node in another segment, the switch will forward the packet only to that segment, isolating traffic from other segments. This increases network throughput and helps balance the network's load. Also, as Ken

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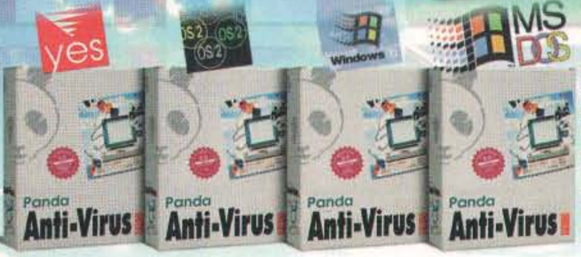

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Lu points out, "You have to add a switch if there are more than two hubs in a network." With a much smaller forwarding delay than that of a bridge, you can connect as many hubs as needed. This overcomes the limitations of Fast Ethernet repeater hubs. The Taiwanese believe that, at a corporate level, mixed 10/100 hubs and switches will replace pure 10-Mbps products. They believe that it makes good planning sense to migrate to the higher performance mixed products. The 10-Mb switching hubs seem especially doomed to the technology graveyard. On the whole, however, the Taiwanese believe that 10 Mb will predominate in the network products sold this year because most of the world's companies are small and don't need the throughput of 100 Mbps.

Technology Limits

Fast Ethernet does not now support priority sorting of data, but Ngai at D-Link said that Fast Ethernet will soon have that capability. This is important for videoconferencing applications since the data flow of the videoconference must not be interrupted. Another limitation lies in the number of ports that can be supported, which is now 12. Lu at Accton believes that 24 ports will be available by midyear. The 100-Mbps switching hubs often outperform the systems they are made to support, which is something to consider when making purchase decisions. McLellan at CNet cites the example of customers buying ISA 100-Mb Ethernet cards: Fast Ethernet transfers data at 12.5 MB but the ISA bus is running at only 8 MB. **B**

WHERE TO FIND

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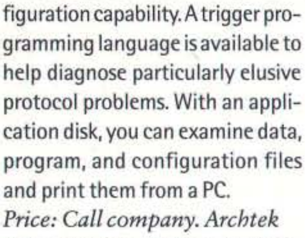
AMONG THE MORE SPECIALIZED OFFERINGS in Archtek Telecom's SmartLink range is the DS-500 protocol analyzer, a rugged tester of data communications malfunctions. It features protocol monitoring, analysis, and simulation, bit error rate testing, and terminal emulation for all common protocols. Compact and lightweight, the DS-500 is ideal for portable field service and maintenance. There is a full ASCII keyboard, a large graphics display, softkey-driven menus, and an auto-configuration capability. A trigger programming language is available to help diagnose particularly elusive protocol problems. With an application disk, you can examine data, program, and configuration files and print them from a PC.

Price: Call company. Archtek Telecom Corp., Taipei, Taiwan, +886 2 218 8730; fax: +886 2 914 6299; sales@archtek.com.tw; http://www.archtek.com.tw.
Circle 1029 on Inquiry Card.

Establish Remote Presence via ISDN

OFFERING VARIOUS COMBINATIONS OF communications protocols, the TA+POS, TA+PPP, and TA+DAA ISDN terminal adapters support telephony, fax, and 33.6-Kbps modem applications. The devices use the protocols V.110, X.75 PAD, and X.31 via D and B channels and thus integrate with a wide range of applications such as credit card readers and POS terminals.



Price: Call company. Stollmann E+V GmbH, Hamburg, Germany, +49 40 890 88-0; fax: +49 40 890 88-444; info@stollmann.de; http://www.stollmann.de.
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Add Serial Ports to Mobile Computer

INTEGRATING TWO HIGH-SPEED SERIAL ports into one dual-function PC Card, the new DoubleSerial (S2S) board brings greater flexibility to mobile computer users. Both serial ports utilize 16550 UARTs and have built-in data buffers, allowing Windows and OS/2 users to run modems at full speed without wasting bandwidth by retransmitting missed characters. Two DB-9 connectors are included to connect to serial peripherals such as label printers or bar code scanners. The serial ports install as standard COM ports and automatically use the next logical default address.

Price: £137. Premier Electronics, Waltham Cross, U.K., +44 1992 634652; fax: +44 1992 634616; sales@premierelect.co.uk.
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Storage

SSA Storage System for NT and NetWare

ELIMINATING BOTTLENECKS IN CLIENT/SERVER NT and Novell networks, the FT3 disk subsystem offers up to 72 GB of storage space in one compact enclosure. The system comes with PCI and Serial Storage Architecture controllers and cables. The FT3 supports several network topologies with a transfer rate of up to 80 MB per second.

Price: Call company. Computer Design Group, Manchester, U.K., +44 161 8724277; fax: +44 161 8720792; 72004.2414@compuserve.com.
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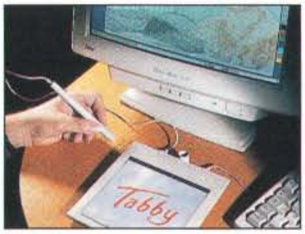
Graphics Tablet

New Tablet and Pen for Windows PCs

TABBY, A GRAPHICS TABLET, CONSISTS OF A 176mm by 165mm tablet area, a stylus, and a communications cable to connect to the serial port of a PC. It is ergonomically designed and feels more natural and easier to use than a mouse, which should provide better cursor control. The stylus, about the size of a pen, has two integrated buttons similar to those of a mouse. Resolution is 2048 by 2048 pixels.



Price: Starts at £69. Graftek, Watford, U.K., +44 1923 248222; fax: +44 1923 244041; http://www.graftek.co.uk.
Circle 1035 on Inquiry Card.

Keyboards

Cherry USB Keyboard

CHERRY IS OFFERING A NEW UNIVERSAL Serial Bus keyboard as part of the company's MX3000 family. It comes in two versions: with and without "unpowered" USB hub functionality. Three connector jacks at the back of the keyboard are designed to accept low-speed (1.5-Mbps) or high-speed (12-Mbps) traffic.

Price: DM 299. Cherry, Auerbach, Germany, +49 9643 180.
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Printers

Printers Attach to Compaq Notebooks

HANTZ & PARTNER'S NEW PRINTSYSTEMS fit into the back of the Compaq Contura Aero and other mobile computers, thus eliminating additional power supplies and cables. These ink-jet printers provide 360-by 360-pixel resolution and include 25 scalable Bitstream TrueType fonts. Despite the printers' physically close connection to the computer, other external jacks for mouse, keyboard, and monitor remain accessible.

Price: DM 1198. Hantz & Partner, Gundelfingen, Germany, +49 761 592100; 100431.2606@compuserve.com.
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Monitors

Flat-Panel Monitor

MICROVITEC'S NEW SUPERVGA LCD MONitor features a 30.7-cm TFT screen with a maximum resolution of 800 by 600 pixels and a 256K color depth. An on-screen display allows you to make adjustments easily from the front panel. The monitor complies with Energy Star and VESA DPMS standards.

Price: About £1299. Microvitec, West Yorkshire, U.K., +44 1274 390011; fax: +44 1274 734944.
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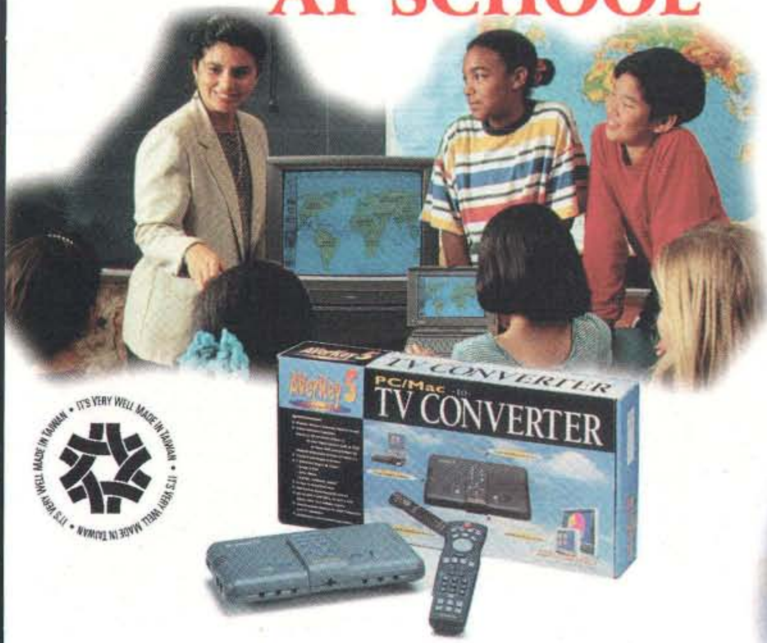

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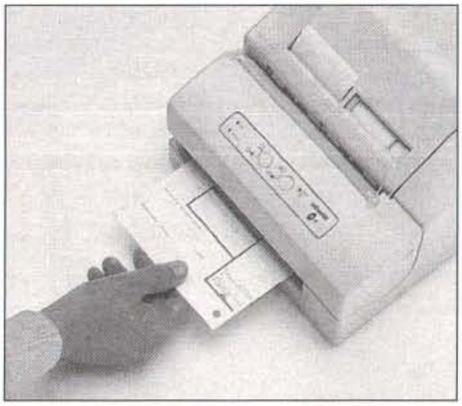

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SOFTWARE

Mapping

Visualize That Telecom Network

DESIGNED TO VISUALIZE MAPS AND GRAPHics for planning, engineering, and supervising telecommunications, power plants, and transport networks, NetGraph lets users create applications with a minimum of programming skills. NetGraph's tools include a development kit, a graphics kernel, and a dynamic data capture system. With its sophisticated layout algorithms, the system accurately computes geocoded graphs, tree structures, and block diagrams. NetGraph applications run on Windows, Unix, and OS/2. *Price: Call company. BINTTA, Montrogue, France, +33 1 41174171; fax: +33 1 47352105.*

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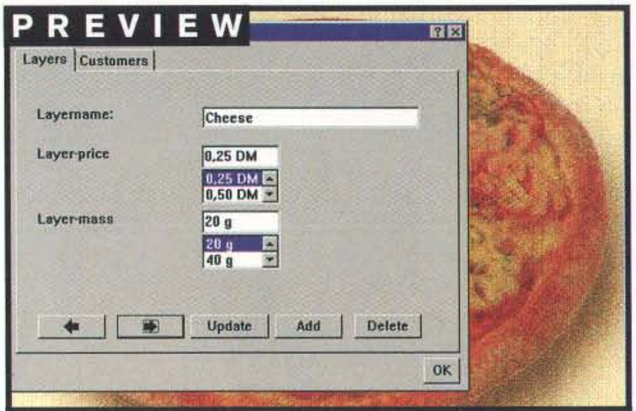
PREVIEW



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Layer-price: 0,25 DM (0,25 DM, 0,50 DM)
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Multiplatform Development Library for Office Applications

The StarView C++ library helps software developers keep the face of an application identical under a multitude of different platforms. This object-oriented GUI library uses its own resource script format. It comes with a design editor and several resource compilers. The library includes language support for English, German, French, and other European languages, full printer support, endian-aware classes, a platform-independent file specification, and drag and drop. Star Division, the developer of StarView, uses the library to program its own office suite.

Version 3.0 now comprises performance-optimized element functions and multithreading for Windows 95/NT and OS/2 applications. There are also new GUI components like progress bars, dockable toolbars, and multipage dialogs.

The 3.0 major redesign may produce incompatibilities with previous versions. However, a converter program helps translate existing StarView applications so they'll work with the new version.

I tested StarView 3.0 for Windows 95/NT with Microsoft's Visual C++ 4.0 compiler and found it to be a comprehensive and well-bred function library. Star says the Windows 3.1, OS/2, Mac OS, and several Unix versions of the StarView C++ library should be released by the time you read this. **–Bernhard Steppan**

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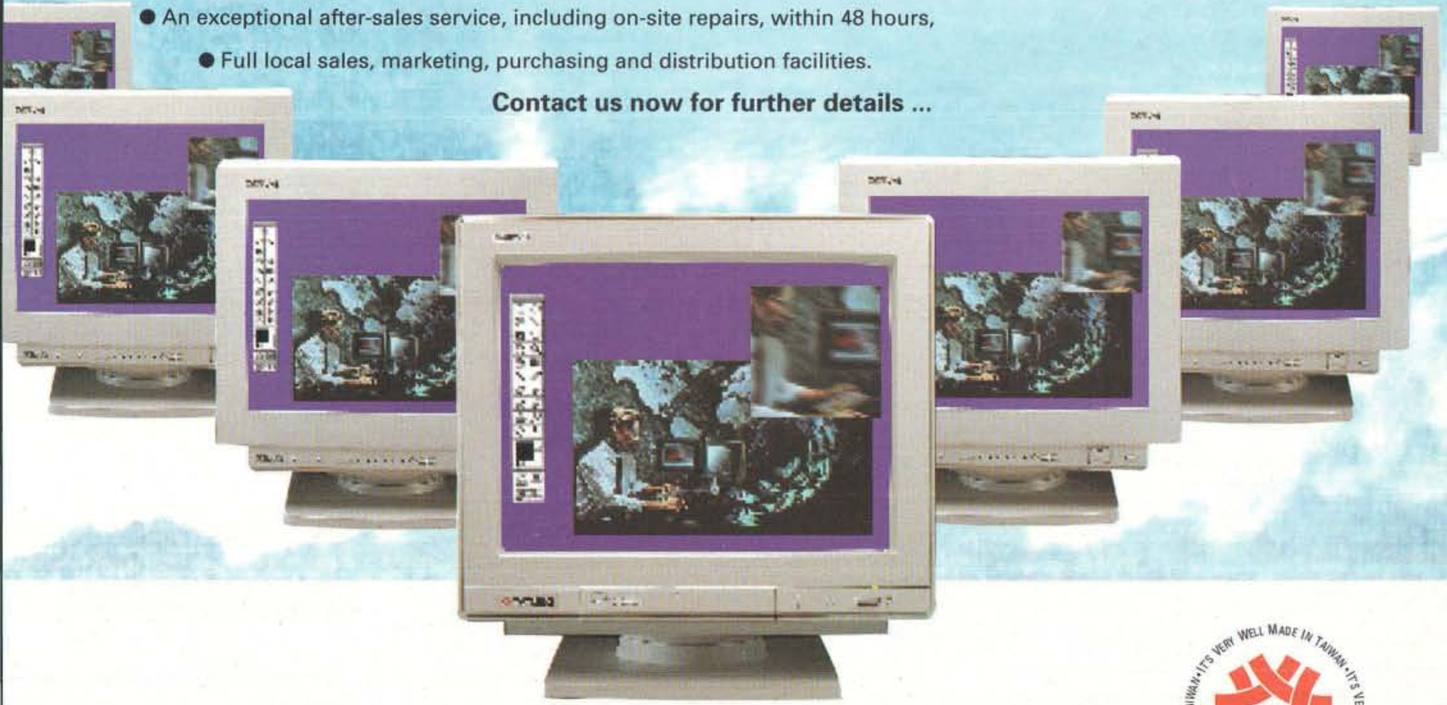

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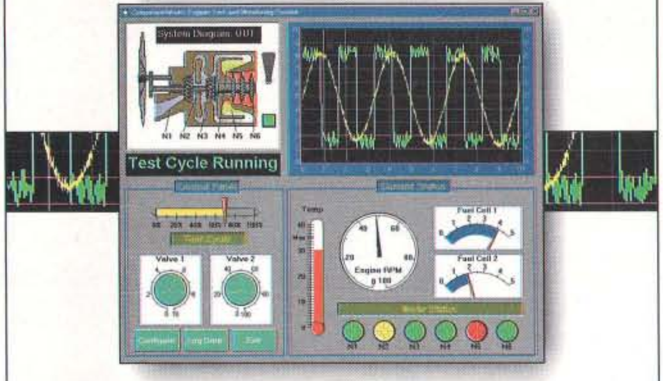
Instrumentation Software News



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32-bit Map Components for Windows

MAPSERVER 3/32, A REUSABLE COMPONENT library for mapping and geographic information systems, lets developers embed high-precision maps into customized applications developed in Visual C++, Borland C++, Delphi, or Visual Basic. It provides vector and raster graphics with optimized display and good performance. Components include DLLs, C++ classes, OCXes, and a visual component library.
Price: £795. Geosoft, Leeds, U.K., +44 113 2344000; fax: +44 113 2465071.
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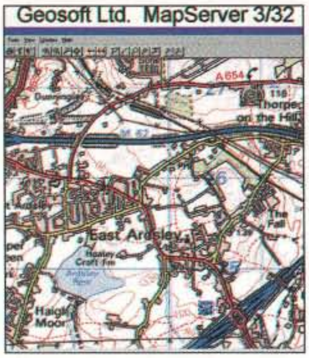
Geosoft Ltd. MapServer 3/32

Development Tools

Object-Oriented Image Processing

IMAGE++ COMBINES A GRAPHICAL DEVELOPMENT environment with digital image processing under Windows 95 and NT. It can simultaneously present data flow diagrams and corresponding C++ source code. You can also incorporate existing external image operators and DLLs.
Price: Call company. Leutron Vision, Glattbrugg, Switzerland, +41 1 8100676; fax: +41 1 8109440; http://www.leutron.com.
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Real-Time System for Intel Processors

A REAL-TIME MULTITASKING ENVIRONMENT for 32-bit embedded systems, the RTKernel-32 complies with Borland C++, Visual C++, and Watcom C++ compilers. It includes a portable kernel that is completely written in ANSI C. It supports 386, 486, Pentium, Pentium Pro, and NS489SXF processors and contains drivers for memory management, floating point, and interrupts.
Price: Call company. OnTime Informatik, Hamburg, Germany, +49 40 437472; fax: +49 40 435196; 101212.3101@compuserve.com.
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OS Launcher

Boot Manager Gives You OS Choice

MULTI-BOOT IS AN INTERACTIVE OPERATING system launcher that lets you switch easily between different operating systems by installing four primary partitions. At boot time you can select which of the primary partitions you want to activate. The system launcher supports all major operating systems and automatically replaces other boot managers.
Price: Call company. Tec-Advice, Vevey, Switzerland, +41 79 210 21 22; meister@tec-advice.com; http://www.tec-advice.com.
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Engineering

Comprehensive FEM Analysis

INTEGRATING AUTOMATIC MESH GENERATION, iterative solvers, materials databases, and post processors, Argos Systemes' Systus+ is a comprehensive finite element package. With its broad range of modules you can solve mechanical, thermal, and electromechanical problems and analyze production processes and coupled systems. Data can be exchanged with other software packages via IGES or STEP. The program runs on Unix workstations and supercomputers but results

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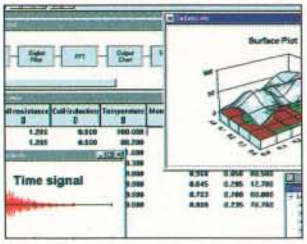
Data Mining

DataEngine for 32-bit Windows

THE NEW 32-BIT WINDOWS VERSION OF the DataEngine data analysis system can now import ASCII and Excel data. Version 2.0 supports additional data visualization techniques and lets users define their own data mining procedures.



Price: Starts at DM 5990. MIT, Aachen, Germany, +49 2408 94580; fax: +49 2408 94582; dataengine@mitgmbh.de; http://www.mitgmbh.de
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The Web

HTML Tool for Big Documents

DESIGNED FOR PUBLISHING LARGE DOCUMENTS on the World Wide Web, the Intraweb HTML editor can automatically convert files that are hundreds or thousands of pages long. When combined with Virtual Media's Hypertext Development Kit, Intraweb provides a fully integrated, large-scale, on-line publishing solution across multiple platforms.
Price: £399. Softklone, Loudwater, U.K., +44 1628 819200; fax: +44 1628 810314; sales@softklone.co.uk.
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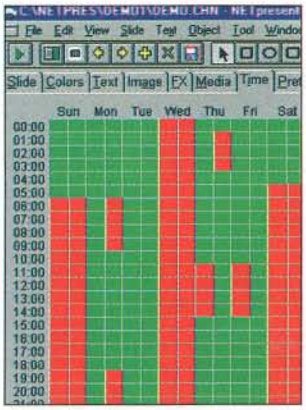
Presentation Tool for Intranets

WITH NETPRESENTER 3.0 AN ORGANIZATION can deliver customized news and information over the World Wide Web or a corporate intranet. An easy-to-use editor lets you create a presentation and then integrate it into HTML. Users can view the presentation using a Netscape plug-in. Authors can assign links to other information objects.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Price: DM 749. Netpresenter BV, Beek, The Netherlands, +31 464 370886; fax: +31 464 360188; netpresenter@eureka.nl; http://www.eureka.nl/netpresenter.
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Bandai Digital's @World Web-browsing system may one day be the Mac network computer for corporations. By Peter Wayner

On TV: The Set-Top Morphing PowerPC

A Macintosh with only 5 MB of RAM and a 66-MHz PowerPC 603 processor hardly seems exciting. Set it on a TV with an Internet hookup, however, and a $499 Mac clone begins to make great sense. Based on Apple's Pippin technology, Bandai Digital's @World runs software from its internal CD-ROM or the Internet. It's a well-implemented unit that should infiltrate the set-top-box market and might even steal market share from games manufacturers, such as Nintendo.

@World
$499
(with 66-MHz PowerPC 603, 5 MB of RAM, quad-speed CD-ROM, 28.8-Kbps modem, cables, and browser software)

Bandai Digital
Entertainment Corp.
La Mirada, CA

(310) 404-1600
fax: (310) 404-1900

http://www.atworld.com/

Circle 1057 on Inquiry Card.

Housed around a quad-speed CD-ROM drive, Bandai's @World Web PC runs modified Mac software. The keyboard is optional.

PHOTOGRAPH: BRIAN WILDER © 1997

Portability is @World's great strength. Stripped of multitasking code, its lean Mac OS fits in 1 MB of RAM. Yet all the standard Toolbox calls are available, including such popular extensions as QuickTime and QuickDraw, so Mac applications run with few modifications. As a result, software for @World should be easy to come by. The @World unit itself comes with a slightly retooled version of the Spyglass Internet browser, and its flashy introductory CD was produced with Macromedia and QuickTime, two well-understood multimedia tools.

The unit's Mac compatibility extends to hardware. You can connect standard Apple ink-jet printers, keyboards, and mice to @World, although Apple Desktop Bus (ADB) devices require an adapter. The @World unit is also networkable, running AppleTalk through its serial port.

The graphics subsystem, however, differs from that of a basic Mac. The unit spits out a video signal in standard NTSC, S-video, or standard VGA. The display on NTSC TV has fewer pixels than on a color monitor, but antialiasing hardware keeps the image readably crisp.

The game-like interface controller has a trackball for manipulating the mouse pointer and a four-position button for standard video action. Nine other buttons must be programmed for a particular application. An optional $69 keyboard lets you type e-mail or enter Web addresses. Without it, you have to "type" on a screen keyboard using the trackball.

The @World unit comes with a 28.8-Kbps Motorola modem and cables for setting up a Web browser. As an option, Bandai provides its own Internet service (AtWorld.Net), which costs $19.95 per month. I had the browser up and running within 20 minutes.

Bandai is targeting the retail set-top market for starters, but the company also has plans for the corporate desktop. With a VGA monitor and the optional keyboard, @World would make a perfect $750 network-computer workstation sitting on an AppleTalk network. **B**

TECH FOCUS

Porting Mac Applications

If you're a Mac programmer with a CD-Recordable (CD-R) device, you can port a Mac application to an @World CD-ROM in about 15 minutes. But you'll probably want to modify it first to use more than the controller's trackball and "mouse" buttons.

An @World CD-ROM carries a version of System 7.5.2. A stripped-down Pippin program replaces Finder, but you can add extensions to the CD-ROM. The system reboots each time you insert a new CD.

You'll also need a license and a dongle. The @World unit authenticates each disk it runs, looking for a digital signature that only the dongle can produce. Bandai is planning to make the licensing costs encouragingly low.

RATINGS	
TECHNOLOGY	★ ★ ★
IMPLEMENTATION	★ ★ ★ ★ ★

Peter Wayner is a BYTE consulting editor who lives in Baltimore. You can reach him by sending e-mail to **pcw@access.digex.net.**

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

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and
work less/
ions) read.

Now/ Microsoft® Office 97 is here. It's smarter, friendlier and webbier. Every application has significant improvements—natural-language formulas in Microsoft Excel and "freehand" table drawing in Word, to name a few. There's also a new program, the Outlook™ desktop information manager, that will thrill your control freaks and just plain organize everyone else. The friendlier part comes in the form of Office Assistants, intelligent critters who watch what your users do and offer suggestions, hints and walk-throughs (so you're less likely to be called, paged, or treed by a cranky mob). As for webbiness, not only can your people instantly link to Web sites from inside any app, they can insert hyperlinks from any one document or spreadsheet to any other. And they can save anything in HTML. All using what they already know. (Hello, intranet!) You'll be happy to know that 50% of Office 97 code is shared among apps. Plus, more housework is done at install. And the Network Installation Wizard is your friend. Now/ pinch yourself.

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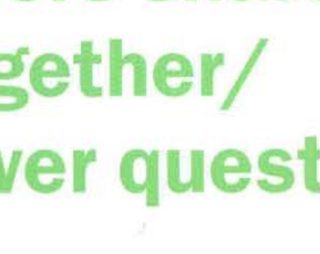

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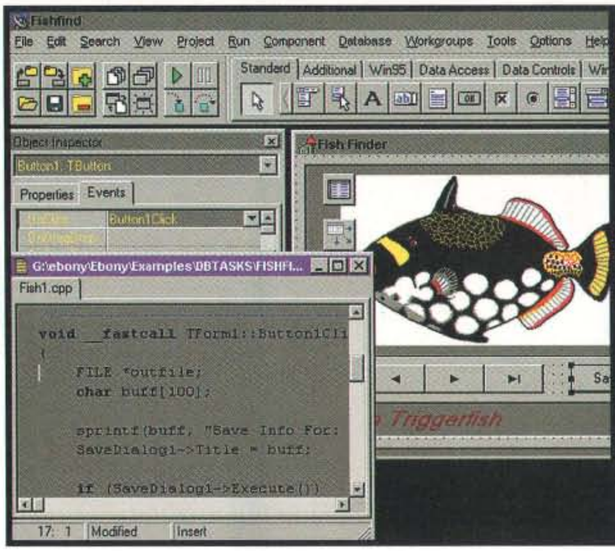
do more

Borland's popular RAD tool finally leaves its Pascal beginnings behind. ***By Rick Grehan***

Delphi Does C++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File Edit Search View Project Run Component Database Workgroups Tools Options Help
Standard Additional Win95 Data Access Data Controls
Object Inspector
Button1: TButton
Properties Events
Button1Click
Fish Finder
G:\ebony\Ebony\Examples\DBTASKS\FISHFI...
Fish1.cpp
Triggerfish
17: 1 Modified Insert

```
void __fastcall TForm1::Button1Cli
{
    FILE *outfile;
    char buff[100];

    sprintf(buff, "Save Info For:
    SaveDialog1->Title = buff;

    if (SaveDialog1->Execute())
```

C++ Builder 1.0
Price to be determined

Borland International
Scotts Valley, CA

(408) 431-1000

http://www.borland.com

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C++ Builder retains Delphi's multiwindowed view of code, objects, and application GUI.

Borland's client/server rapid application development (RAD) system, Delphi, is in the process of mutating. Not that what it is becoming is wholly unrelated to the original, but Borland has replaced a large section of Delphi's DNA. Specifically, Borland took Delphi, turned its foundation language from object-oriented Pascal to C++, and called the result first Ebony (a code name) and now C++ Builder.

Even a moderately attentive passerby would mistake C++ Builder for Delphi. There's the speedbar, the tabbed component palette; below is the Object Inspector window, form window, and code window. The function of each is unchanged. One of Delphi's example programs—Fishfind, which demonstrates the use of a database grid control, image, and memo fields—is replicated in its entirety as a C++ Builder demo. Additionally, Delphi's tool entourage, including ReportSmith and the Database Explorer, also accompanies C++ Builder. The InterBase server for NT has been replaced with the Local InterBase server that runs on NT or Windows 95. (For those who may be porting from Delphi to C++ Builder, C++ Builder's Local InterBase server running on Win 95 appears compatible with Delphi's InterBase NT server. I successfully ran a couple of simple Delphi applications using the C++ Builder InterBase server.)

The similarities reach deeper. The preliminary C++ Builder manuals Borland gave me—Component Writer's Guide and Database Application Developer's Guide—are chapter-for-chapter equivalents to the corresponding Delphi manuals. Actually, they are section-for-section equivalents. The code example snippet given in the Delphi manual for using the `DataSets` and `DataSetCount` properties of the `TDatabase` component (written in OO Pascal) is reincarnated in the C++ Builder manual in C++. Understand, this is a good thing: It's a testimony to the compatibility of the two systems.

Not that there's any need to abandon Object Pascal; C++ Builder's DCC32 compiler can handle Object Pascal code generated in Delphi. I experimented with mixing C++ and Object Pascal code in a sample project and encountered no difficulties doing so.

The foundation atop which C++ Builder stands is Borland's 32-bit 5.0x C++ compiler. (Strictly speaking, the documentation says you must recompile object code and library modules for programs built with C++ 5.01 or earlier.) However, to support such things as C++ Builder components, Borland has had to extend the compiler with several keywords, all of which should be familiar to Delphi developers. For example, the `__property` keyword precedes the declaration of a property field within a class definition. This allows the compiler and linker to generate all the information necessary to provide the property inspector what it needs to correctly display properties associated with a component.

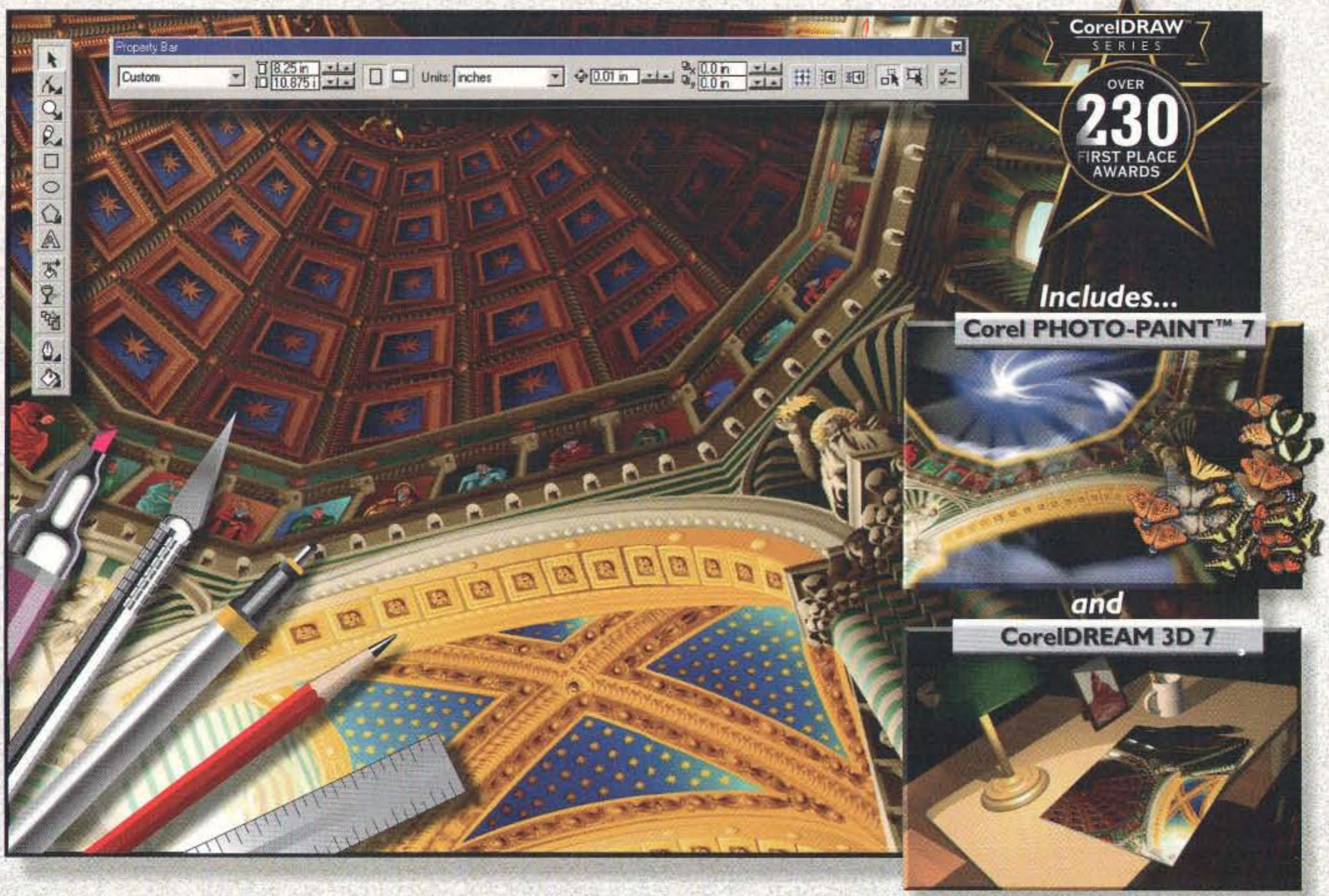
RATINGS	
TECHNOLOGY	★★★★★
IMPLEMENTATION	★★★★★

These are the days of the morphing integrated development environment, when the same development system that builds C++ code also builds Java code (or even Pascal code, as in the case of Metrowerks CodeWarrior). In that sense, C++ Builder, though perhaps unexpected, is at least logical. **B**

Rick Grehan is a BYTE senior technical editor. He is coauthor of The Client/Server Toolkit for C/C++ Programmers *(NobleNet, 1996). You can reach him at* **rick_g@bix.com.**

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

Simply OUTSTANDING



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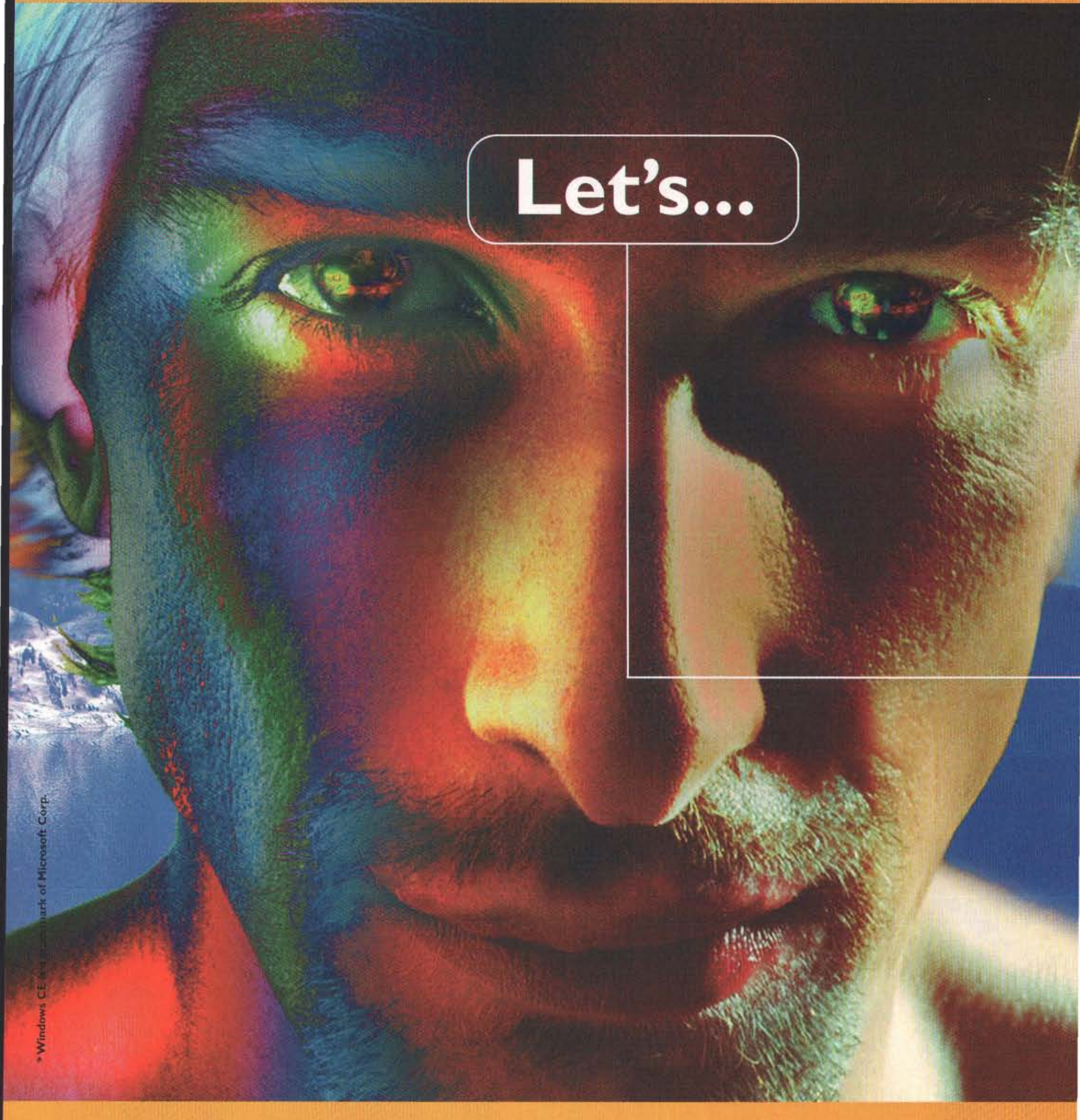

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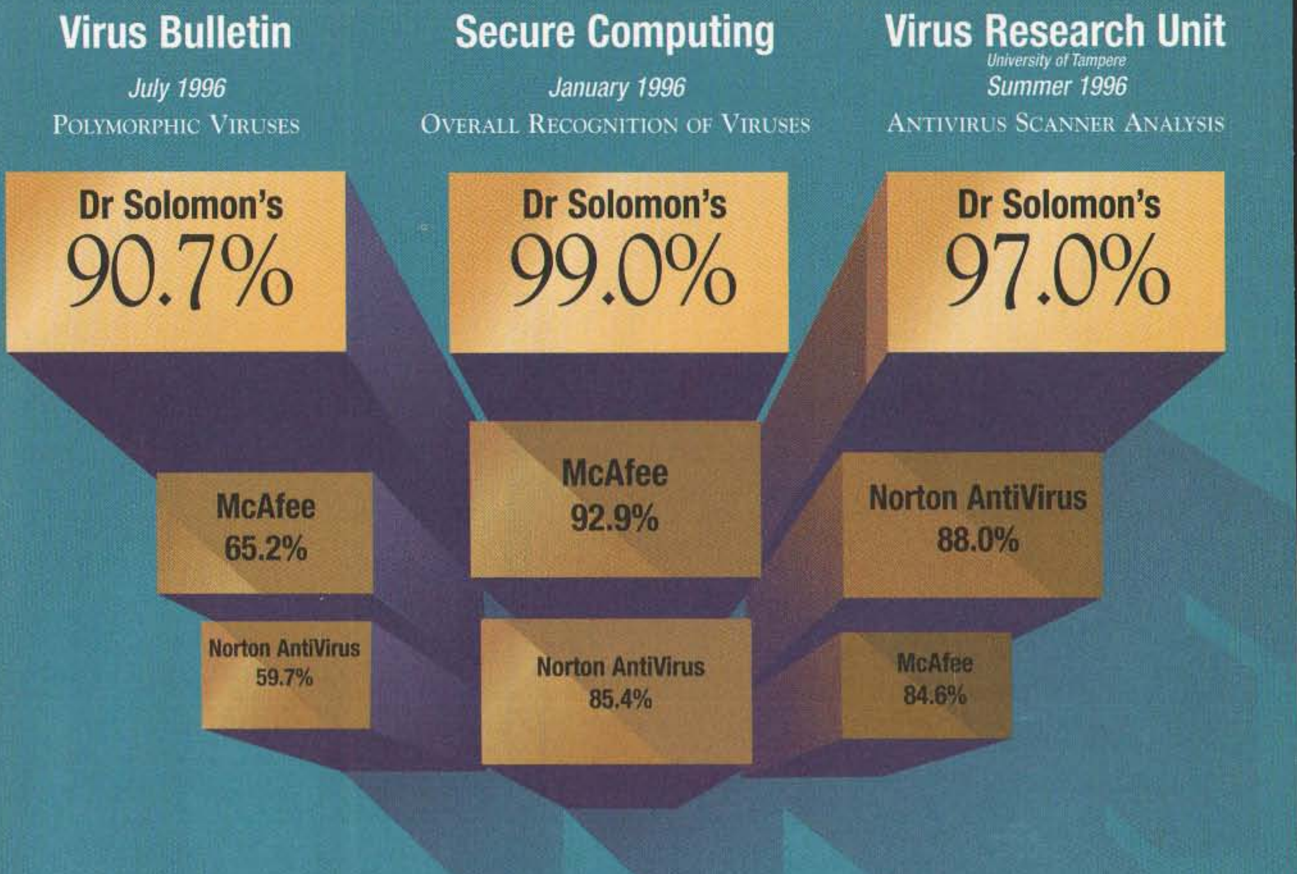

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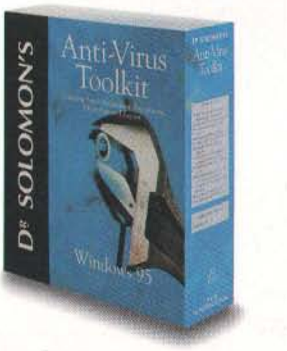

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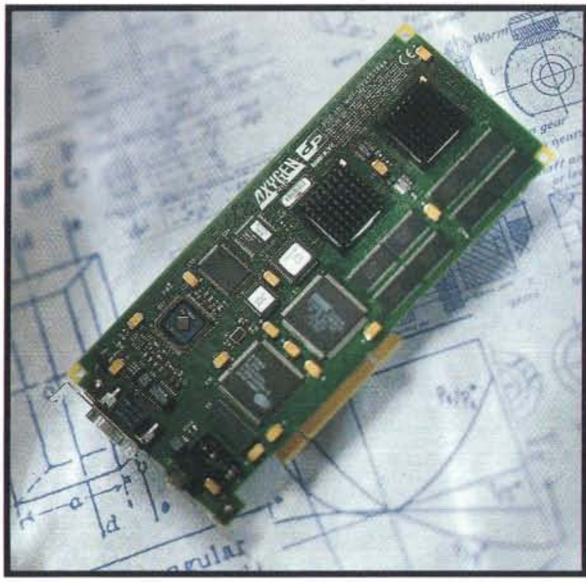
The Oxygen 202 delivers top-notch 3-D graphics performance in less space. By Robert L. Hummel

3-D Mighty Mite

While high-performance 3-D graphics-accelerator cards aren't yet commodities, the era of proprietary graphics adapters is nearly over. The latest entry into this burgeoning field is Dynamic Pictures' new Oxygen 202, a $2795 single-slot PCI card that delivers competitive performance.



Oxygen 202
$2795
(with 16 MB of SDRAM
and two Oxygen chips)

Dynamic Pictures, Inc.
Santa Clara, CA

(800) 464-3348
(408) 327-9000
fax: (408) 327-9010

http://www.dypic.com/

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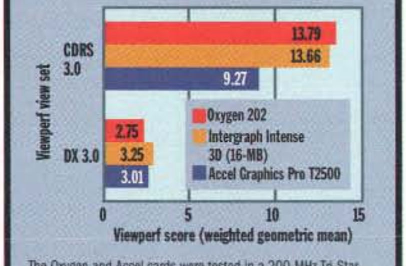
The Oxygen 202 is part of Dynamic Pictures' scalable 3-D graphics-accelerator family. The 202 uses two Oxygen chips in parallel.

The 202 accelerates 3-D graphics functions, and it includes 24-bit z-buffering and perspective-correct texture mapping. As a slim three-quarter-length card, it's smaller than competing cards. Equipped with two of Dynamic Pictures' scalable Oxygen processors running in parallel and 16 MB of synchronous DRAM (SDRAM), the 202 is a more powerful version of the single-chip, 8-MB Oxygen 102 ($1495). Dynamic Pictures has also announced the four-chip, 32-MB Oxygen 402 ($4995).

The 202 supports a wide range of video resolutions and refresh rates. At a 32-bit pixel depth, the 202 resolves 1280 by 1024 pixels at a 75-Hz refresh rate. Dropping the pixel depth to 15 bits (32,000 colors) boosts the resolution to 1600 by 1200 (60-Hz refresh).

Dynamic Pictures provides OpenGL and Heidi drivers for Windows NT 3.51 and 4.0, and it promises Windows 95 drivers for early this year. The 202 contains its own VGA subsystem, but you can still use a separate card for two-monitor operation if you change a jumper on the 202 card. The card also has a connector that supports stereoscopic viewing equipment.

3-D Graphics Performance



The Oxygen and Accel cards were tested in a 200-MHz Tri-Star StarStation SMP Pentium Pro system. The Intense 3D was tested in a comparably equipped Intergraph TD-410.

The Oxygen 202 nudged ahead of Intergraph's Intense 3D card when tested with Parametric Technology's CDRS CAD view set, but it fell back to Glint speed with IBM's Visualization Data Explorer (DX 3.0) view set.

To gauge the Oxygen 202's performance, we ran Viewperf 5.0 with the DX 3.0 and CDRS 3.0 view sets in true-color mode at 1024- by 768-pixel resolution. (This industry-standard OpenGL graphics-performance benchmark is available from http://www.specbench.org/.)

We tested under the same conditions we recently used to compare 3-D graphics workstations (see "Affordable 3-D Workstations," December 1996 BYTE). The host system was a Tri-Star dual 200-MHz Pentium Pro system with 128 MB of memory running NT 3.51. With the DX view set, the Oxygen 202 left Glint 500TX–based cards in the dust, and it was tied with a similarly priced 16-MB Intergraph Intense 3D card. With the CDRS view set, the 202 beat several Glint cards, but it lagged about 10 percent behind Accel's Glint card and about 15 percent behind the Intense 3D.

The Oxygen 202 doesn't break new price/performance ground among 3-D graphics accelerators. But it provides excellent performance at a price comparable to that of other high-end offerings—and in a compact form factor. **B**

RATINGS	
TECHNOLOGY	★★★★★
IMPLEMENTATION	★★★★★
PERFORMANCE	★★★★

Robert L. Hummel (Sullivan, NH) is an electrical engineer, programmer, and consultant. You can reach him at **rhummel@monad.net.**

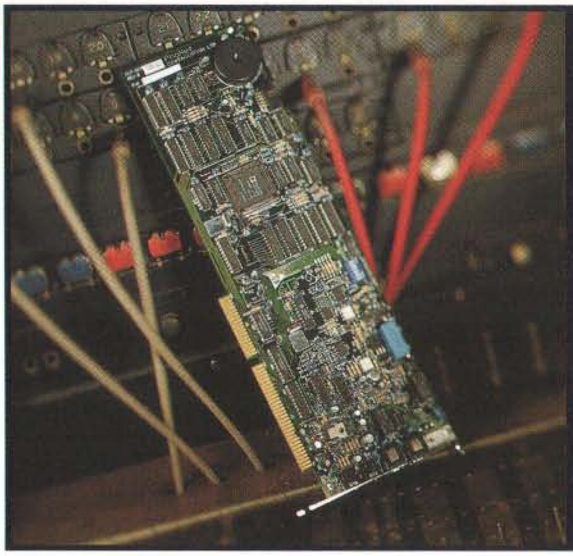
PHOTOGRAPH: BRIAN WILDER © 1997

With EtherPhone, a telephone plugged into your PC instantly gets call transfer, conferencing, and other PBX functions. ***By Barry Nance***

Your PC's Ringing—Answer It!

There's been a lot of noise about making phone calls over the Internet, though in fact the Internet's usefulness for that purpose is limited. On a smaller scale, however, it makes a lot of sense to use your LAN to make internal phone calls. If the organization isn't too big, you might even be able to forgo an expensive, single-purpose PBX telephone system.

That's the idea behind EtherPhone, which adds telephony to an existing Ethernet LAN. An EtherPhone-based LAN offers Windows 95 users these PBX-type features: voice mail, an automated phone attendant, internal and external calls, call transfer, call hold, conference calling, and even music-on-hold. EtherPhone supports Telephony API (TAPI), and you can log calls in a database, such as Microsoft Access. EtherPhone converts the digitized voice signals to TCP/IP data packets (see the Tech Focus).



EtherPhone 1.1
price not announced
(requires Windows 95
or NT)

Phonet Communications
Herzlia, Israel

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phonet@shani.net

http://www.phonet.co.il

Circle 1055
on Inquiry Card.

Administering EtherPhone is as simple as assigning people IP addresses and phone extensions.

You replace the standard Ethernet network interface card (NIC) in each PC with Phonet's ISA-bus 10Base-T network adapter card and add Windows 95 client software. Each EtherPhone card has RJ-45 (network), RJ-11 (phone line), speaker, and microphone ports. The client software allows users to dial, answer, hold, transfer, and otherwise manage phone calls.

TECH FOCUS

Speech as LAN Data

The key concept behind EtherPhone is LAN telephony integration (LTI). Unlike computer telephony integration (CTI), LTI interleaves voice packets with file-sharing packets through the LAN wire.

The biggest drawback to sending voice signals as data packets on an Ethernet LAN is the potential for time lags on a busy network, something a more expensive asynchronous transfer mode (ATM) LAN would not encounter. Phonet engineers circumvent the problem by using faster, digital signal processor–based (DSP) hardware—with an Analog Devices ADSP-2105—and algorithms designed specifically for voice-as-LAN-data.

You need a separate Windows 95 PC running EtherPhone server software to distribute calls to the clients. This server has from one to four cards, each taking up to four outside phone lines. With the maximum 16 concurrent calls, the LAN's bandwidth is pretty well maxed out.

I set up a 133-MHz Pentium PC as an EtherPhone server, connected it to the public telephone network, and plugged a standard phone into each EtherPhone client PC. The server kept up with voice-as-LAN-data, even when the client PC was busy running various Windows programs. But, with just one outside and two inside calls under way, the server needed to be dedicated to telephony. Similarly, a 486 client PC had a hard time keeping up while running other Windows programs.

I was generally pleased by Phonet's marriage of Ethernet and telephony technologies. Many functions have no on-line help, and the software occasionally burped and had to be restarted. But the drivers were reliable: I didn't lose a single phone call to software bugs.

RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★

Despite skimpy documentation, occasional glitches, and a narrow platform focus, EtherPhone is a good choice if you can't afford a PBX for your small office and you want to present a professional image to customers over the phone. **B**

Barry Nance is a BYTE consulting editor. You can reach him by sending e-mail to **barryn@bix.com**.

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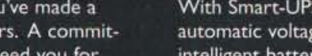

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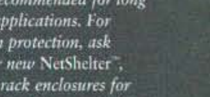

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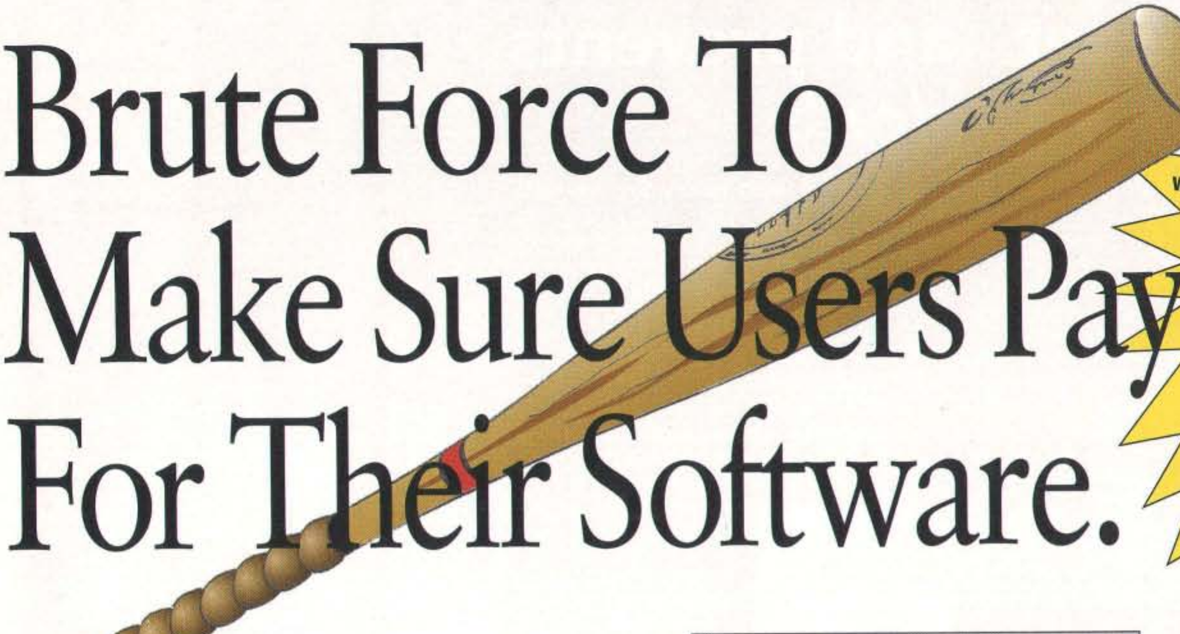

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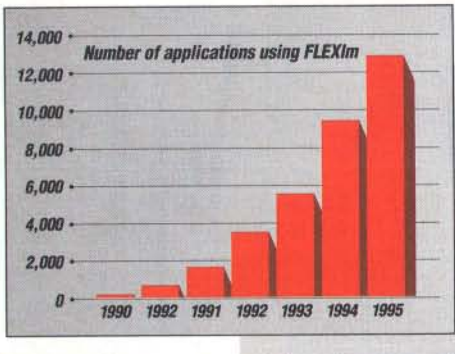

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Circle 188 on Inquiry Card.

A library offers reliable operation for Windows 95 applications.
By João Carreira, Diamantino Costa, and João Gabriel Silva

Fault Tolerance for Windows Applications

An increasing number of business-critical applications are being targeted for the low-end PC market and general-purpose OSes, such as Windows 95 and NT. This class of programs includes on-line transaction processing (OLTP) and data-warehousing applications, control systems, and other business-critical solutions for the finance, telecommunications, retail, and health-care markets.

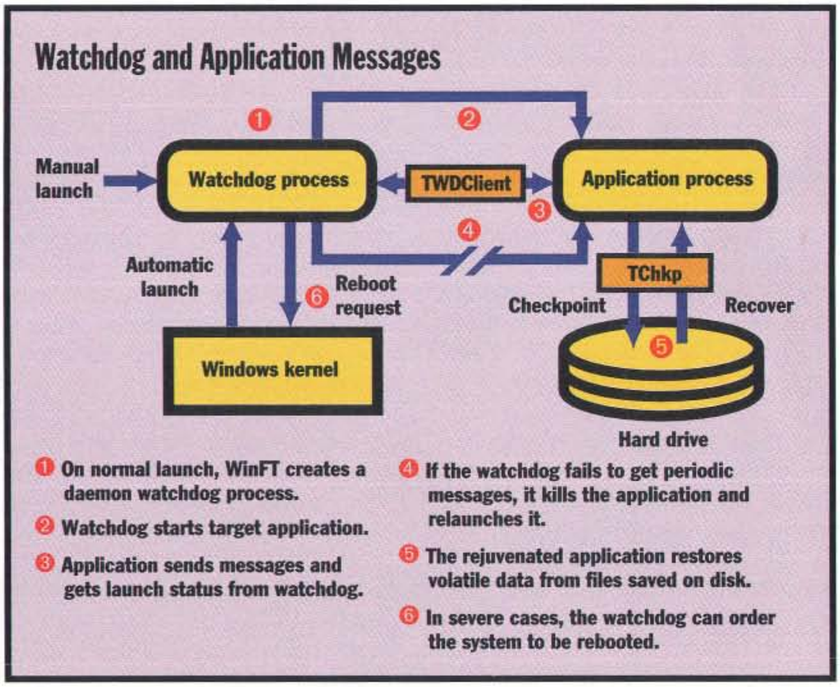
But moving to such systems poses a problem. How can the PC guarantee the continuous availability and data consistency required for these mission-critical applications? Despite the desktop PC's lower costs, running such applications without any fault-tolerance support can be risky—even dangerous.

It is possible, however, to use software to implement a certain level of fault tolerance for desktop PCs. A special library that we've written, called WinFT, provides fault-tolerance support for Win-32 applications. WinFT performs automatic detection and restarting of failed processes; diagnosis and rebooting of a malfunctioning or strangled OS; checkpointing and recovery of critical volatile data; and preventive actions, such as software rejuvenation (i.e., when an application or OS is restarted to get a clean internal state).

WinFT Parts

WinFT is a library of functions that provides fault-tolerance support for Windows applications that must run for long periods of time or nonstop applications, such as database servers and control systems. WinFT was implemented as a set of objects developed with version 5.0 of the Borland C++ compiler. It uses the Win 95 subset of the Win32 API and is available as both a static and a dynamic link library (DLL). The modules and related functions that make up the WinFT library are shown in the table "WinFT Functions" on page 52.

The checkpointing modules set up and keep track of critical data structures that the programmer declares. They also keep track of the declared data structures and manage the task of saving this data to disk. In addition, the modules recover the data when the program restarts after a crash.



Watchdog and Application Messages

① On normal launch, WinFT creates a daemon watchdog process.

② Watchdog starts target application.

③ Application sends messages and gets launch status from watchdog.

④ If the watchdog fails to get periodic messages, it kills the application and relaunches it.

⑤ The rejuvenated application restores volatile data from files saved on disk.

⑥ In severe cases, the watchdog can order the system to be rebooted.

A message-passing scheme tells the watchdog if the process is hung up or is experiencing problems.

The watchdog modules set up processes that monitor the activity of other processes to check for execution problems. A mission-critical application uses WinFT's message-passing functions to indirectly signal the watchdog process if it's caught in a loop or stalled waiting on an OS call. If you don't want to bother with the task of writing exception-handling code within your applications, the WinFT exception-handling module provides a simple API for your use.

WinFT Setup

A `TChkp` object, which manages data checkpointing, is used throughout an application. You create this object with the `TChkp()` function. The function's first parameter lets you specify a directory path and the name of the checkpoint file that stores the critical data. If you want to save a copy of the checkpoint file on a remote system, you specify this path in `TChkp()`'s second parameter. This lets you restart the application from a backup PC in case of a serious crash.

The three checkpointing methods `Critical()`, `CheckPoint()`, and `Recover()` should be used according to

WinFT Functions

Checkpointing	`TChkp::TChkp(char *name, char *apath, int mode, int amode, BOOL *error)`	Create checkpointing object, assign backup data files
	`BOOL TChkp::Checkpoint()`	Declare critical data structures
	`BOOL TChkp::Critical (void *data, int size)`	Save data to disk
	`BOOL TChkp::Recover()`	Restore data after a system crash
Watchdog functions	`TWDClient * InitWatchD(uint idle_cnt2_rejuv, uint errors_2_restart, uint time_ref, uint restarts_2_reboot)`	Create watchdog process
	`void CloseWatchD()`	Terminate watchdog monitoring
	`BOOL TWDClient::ImAlive(void)`	Send periodic "I'm Alive" messages to watchdog process
	`BOOL TWDClient::Error(int err_code)`	Send error messages to watchdog process
	`BOOL TWDClient::Idle(void)`	Send idle messages to watchdog process
	`BOOL TWDClient::SetImAliveTimeout (uint timeout)`	Assign time-out interval to detect hung processes
	`int TWDClient::GetStartMode(void)`	Determine cause of application start and perform recovery if necessary
Exception handling	`BOOL InitXceptionHandling()`	Exception-handling function and macros

some rules that are intuitive but should be clearly stated. The first step is to declare the critical data structures using `Critical()`. You invoke this method as many times as necessary, providing the function with a pointer to the critical data structure and its size in bytes.

You call `Checkpoint()` to save all critical data structures on disk and use `Recover()` to refill these data structures using data from the file. After an application starts and all the critical structures are declared, you must determine whether the application should recover data from the disk. This is in case the application is restarted due to an error. A `GetStartMode()` method, described later, fetches this information from a `TWDClient` object that's managed by a watchdog process.

Let Loose the Watchdog

The watchdog can be a separate process, with a graphical interface that lets you set up all the parameters interactively, or a hidden process launched through `InitWatchD()`. `InitWatchD()` creates the `TWDClient` object and a daemon-style process that monitors the health of a specific application. When the application is first launched, `InitWatchD()` checks to see if it was launched directly by the user. If so, `InitWatchD()` never returns, but instead launches another instance of the application.

The parent process then turns itself into a watchdog process that monitors the newly launched application. When the second instance of the application calls `InitWatchD()`, it detects that the application was launched by the watchdog. In this case, `InitWatchD()` returns, and real application code executes.

Within the application, you use WinFT's watchdog methods `ImAlive()`, `Error()`, and `Idle()` to send messages to the watchdog process. These messages can be "I'm Alives" (also called heartbeats), error messages, or idle notifications, and the watchdog daemon handles them in different ways. Periodic heartbeat messages tell the watchdog that the application is active. Error notifications cover those situations where the application is still active but is detecting errors and having problems getting a job done.

Finally, if the application is idle—due to user inactivity or the absence of client requests (if it's a server application)—it should send idle messages to the watchdog so that it can initiate maintenance or preventive actions, such as software rejuvenation. The figure "Watchdog and Application Messages" on page 51 depicts the interaction between a Windows application and the watchdog process and between the watchdog and the OS. The application uses `GetStartMode()` to see why the watchdog started it and decides if recovery actions, such as reading the checkpoint files into memory, should be performed.

Recovery Routes

The watchdog takes two actions, based on data received from the user application. The first is a simple relaunch of the application when a specified threshold of successive error messages is reached or because the "I'm Alive" time-out expires (i.e., the application is hung up).

The other, more drastic, action is to reboot the machine when successive application restarts fail to clear the problem. This typically occurs when an application keeps reporting OS errors and rejuvenation of the OS is a likely solution. To guarantee that the application launches normally after a system reboot, you should place the application's executable file in the Windows Startup Folder.

WinFT was used successfully in the field as a support library for an industrial-control application running under Win 95. The application's availability was increased, and it was able to provide nonstop real-time service.

WinFT seems to be a promising solution for the increasing number of applications that need to run perpetually, such as control systems and servers in client/server applications. It is publicly available from the BYTE Web site (http://www.byte.com/art/download/download.htm), and the latest updates are available from the Dependable Systems Group Web page (http://dsg.dei.uc.pt).

João Carreira, Diamantino Costa, and João Gabriel Silva work at the Dependable Systems Group in the Department of Informatics Engineering at the University of Coimbra in Portugal. João Carreira can be contacted at **jcar@eden.dei.uc.pt.**

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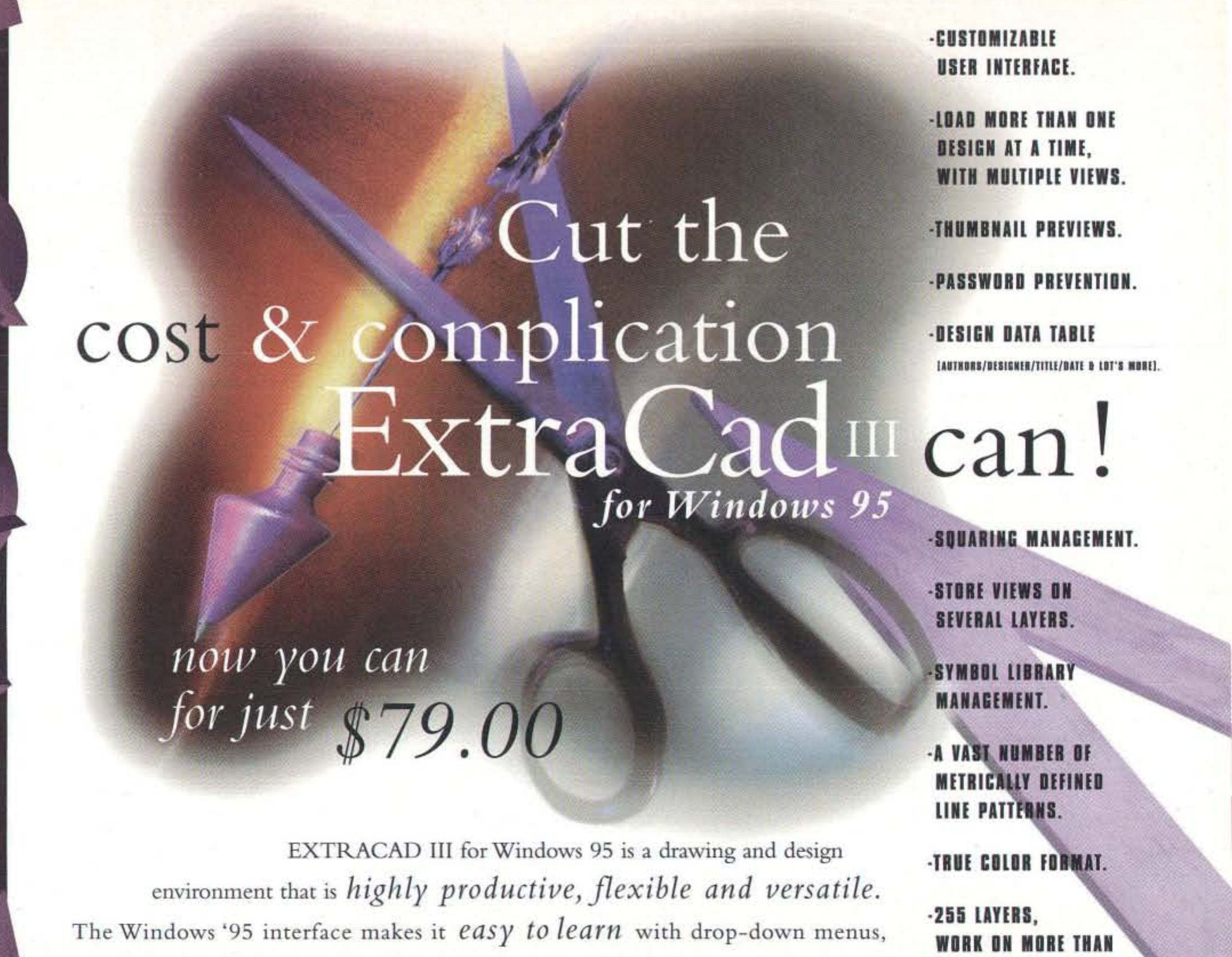

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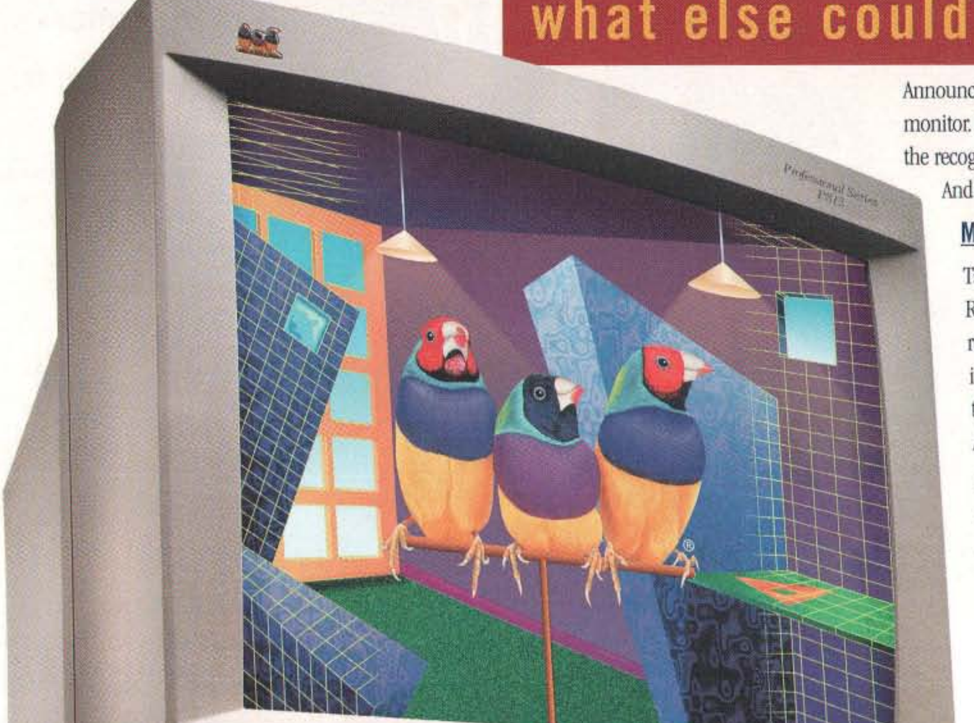

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Optimal Resolution	1800 x 1440 @ 76Hz	1600 x 1200 @ 85Hz	1600 x 1200 @ 76Hz	1600 x 1200 @ 77Hz	1280 x 1024 @ 80Hz
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MSRP**	$2,195	$1,895	$1,745	$999	$799

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Circle 157 on Inquiry Card (RESELLERS: 158).

An update on the PPP protocol and its use within enterprise networks. By Jeffrey N. Fritz

Building Bridges and Secure Connections

Connecting a remote machine as a node on an enterprise network or to the Internet involves the use of some tricks of the trade. Modems and ISDN terminal adapters are often used for remote network access, but they aren't really network devices. Rather, they are serial devices operating over circuit-switched telephone connections. This contrasts with directly connected network nodes, which are based on packet-based connectionless topologies. Given this difference, a serialized protocol is required to move connectionless network packets over the connection-oriented telephone network.

Real-World Connections

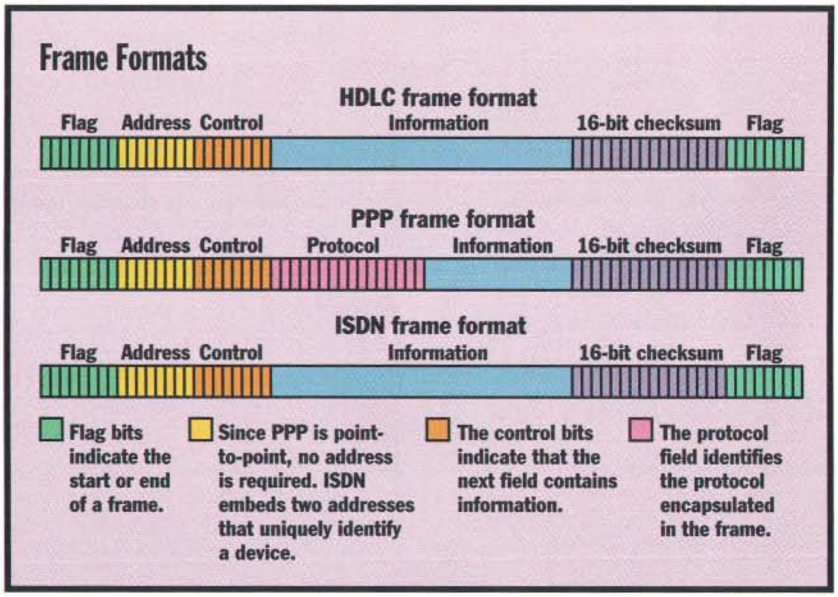
For remote LAN access, the protocol of choice is the Internet Engineering Task Force's (IETF's) Point-to-Point Protocol (PPP). PPP is defined in RFC 1134, "The Point-to-Point Protocol: A Proposal for Multi-Protocol Transmission of Datagrams over Point-to-Point Links" and RFC 1661, "The Point-to-Point Protocol (PPP)." These RFCs provide a standardized method for transporting multiprotocol datagrams over point-to-point links.

The PPP algorithm moves network packets over a modem or ISDN link by placing them inside a high-level data-link control (HDLC) frame. The algorithm then transfers the frames over the circuit-switched connection to the network. Once the packets arrive at their destination, the PPP algorithm removes them from the frames and places them on the network. Interestingly, both ISDN and PPP employ the same HDLC-based frame structure, as shown in the figure "Frame Formats" above.

PPP can operate over a variety of serial devices, as well as over just about any serial link, including those using analog modems. But when it comes to PPP performance, throughput is important. For decent PPP connections, the connection should use nothing less than a 14.4-Kbps (V.32bis) modem on both ends; 28.8-Kbps (V.34) or faster modems are highly recommended. ISDN devices generally have sufficient throughput (64 Kbps on two B channels) to do a good job of supporting PPP sessions.

On an enterprise network, a communications server and a bridge/router bank provide access for PPP connections. These same tools are used by an Internet service provider (ISP) offering Internet access. The user's PC establishes a connection to the network through PPP client software running on the PC.

The same method applies whether modems or terminal adapters are used on the remote side to connect to the Internet or to an enterprise network. A PPP-based package, such as NetManage's Chameleon or Novell's LAN Workplace for Windows, is installed in the remote PC. The PC is then connected via the serial port to a modem or terminal adapter.

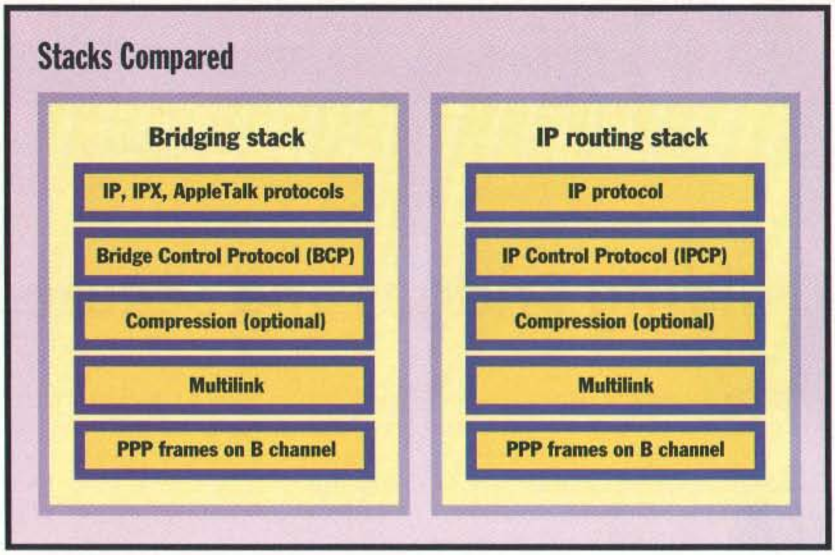

Frame Formats
HDLC frame format
Flag
Address
Control
Information
16-bit checksum
Flag
PPP frame format
Flag
Address
Control
Protocol
Information
16-bit checksum
Flag
ISDN frame format
Flag
Address
Control
Information
16-bit checksum
Flag
Flag bits indicate the start or end of a frame.
Since PPP is point-to-point, no address is required. ISDN embeds two addresses that uniquely identify a device.
The control bits indicate that the next field contains information.
The protocol field identifies the protocol encapsulated in the frame.

Both ISDN and PPP use the same HDLC-based frame structure, which expedites the process of routing frames through a network.

PPP packages generally include dialer software, which handles the task of establishing the telephone connection. Once the connection is made to the network, PPP negotiates the Link Control Protocol (LCP) and authenticates the remote device. If these negotiations are successful, the network session begins.

Bridging Issues

Terminal adapters and modems are not the only devices that have the ability to support PPP. A PPP connection can also be made through a remote side bridge or router that supports PPP internally. With a bridge or router, the remote PC is connected via a network interface card (NIC)



Both stacks present the same interfaces; this allows easy integration of devices into a large network.

over a small LAN between the PC and the ISDN device. The negotiation process works in much the same manner to bring up a PPP session with a bridge or a router as it does with a modem or a terminal adapter.

An enhancement to PPP, called Multilink Point-to-Point Protocol (MP), is defined in IETF RFC 1717, "The PPP Multilink Protocol (MP)." MP has the ability to aggregate multiple ISDN B channels for enhanced throughput. It can handle a maximum of 384 Kbps (six B channels) before compression, which is certainly a respectable throughput rate in anybody's book.

PPP can be used whether the serial connection is provided by bridges or routers. But there are differences between PPP connections over bridges and those over routers. Bridges tend to be simpler to configure but provide fewer capabilities than routers. The figure "Stacks Compared" above shows a typical PPP bridging stack and a PPP IP routing stack.

Note that the same interface appears at the top and bottom layers of both stacks. Whether bridging or routing is in use, the network protocol is always on the top layer. The bottom layer is the PPP framing on the B channels. That is, the layer is ISDN layer 2, where the PPP packets are placed in HDLC frames.

The difference between bridging and routing stacks occurs when the control protocol is in use. A bridging stack uses the IETF-defined Bridge Control Protocol (BCP). BCP, which operates on layer 2, is responsible for examining the packets and determining their destination. A routing stack operates on layer 3. It supports many of the functions that are typically found in routing, such as time to live, least-cost routes, parallel links, protocol filtering, and other functions.

While BCP supports all protocols, routing stacks must be created to support specific protocols. For example, the IP Control Protocol (IPCP) is an IETF-defined protocol that performs the routing network functions for TCP/IP. If IPX is implemented in the router, then the IPX Control Protocol (IPXCP) is used in place of, or in addition to, IPCP. Similar control protocols are being developed for other network protocols.

Secure Conduits

The IETF has defined two protocols for security over PPP connections. The Password Authentication Protocol (PAP) and Challenge-Handshake Authentication Protocol (CHAP) are both specified in RFC 1334, "PPP Authentication Protocols." PAP and CHAP are often included as internal protocols in ISDN network devices.

PAP and CHAP both support the authentication of remote devices. However, PAP provides only a basic authentication level. Under PAP, an identification, a password, and account pairs are repeatedly sent by the remote device to the authentication device. This is done until authentication is acknowledged by the authentication device or the connection is terminated.

Since PAP sends passwords "in the clear," there's some risk that the connection's security may be compromised. For example, a hacker could record the legitimate user's PAP log-in sequence and then play back the recorded log-in at a later time to gain access to the network. Since PAP has no time-out function, the hacker is free to use repeated trial-and-error attempts.

CHAP is a more robust authentication protocol. The CHAP algorithm depends on a calculated value, or "secret," that's at least 1 octet in length and is known only to the authenticator and the remote-access device. Because the CHAP secret is never sent over the link, it's highly effective against playback and trial-and-error attempts.

Instead of sending the secret, CHAP sends a "challenge" to the remote unit attempting to connect to the network. The remote unit responds with a value calculated by a common algorithm used by both devices. The authentication device checks the response against its own calculation of the expected value. If the values match, the authentication is acknowledged; otherwise, the connection is terminated. RFC 1334 expects each new challenge value to be unique, which prevents an attacker from using a previously intercepted response to obtain network access.

CHAP and PAP help ensure that the correct remote device has dialed in to the network. You should remember, however, that both protocols authenticate only the remote device. They do not authenticate the user or the calling number. Therefore, they should always be used in combination with other security methods, such as log-in sequences and caller ID. Additional security measures, such as Kerberos, the Terminal Access Controller Access Control System (TACACS), and the Remote Authentication Dial-In User Service (Radius), should be used to supplement PPP security. **B**

Jeffrey N. Fritz is a telecommunications engineer for West Virginia University's Telecommunications and Network Services department. He is the author of Remote LAN Access: a guide for networkers and the rest of us *(Manning Press/Prentice-Hall PTR, 1996). You can contact him at* **jfritz.wvu.edu**.

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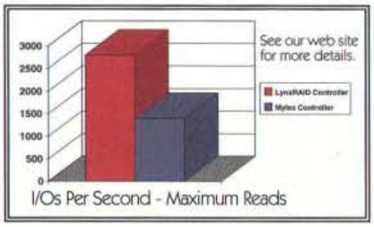

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Slots: (6) PCI, (4) EISA	32MB of 60 ns RAM Expandable To 512MB, ECC Supported	Slots: (4) PCI, (4) ISA	Expandable To 256MB,ECC Supported	64MB of 60 ns RAM to 1GB
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A new library and API enable preemptive multitasking and multiprocessing on Mac OS systems. ***By Tom Thompson***

The Mac Goes Multiprocessor

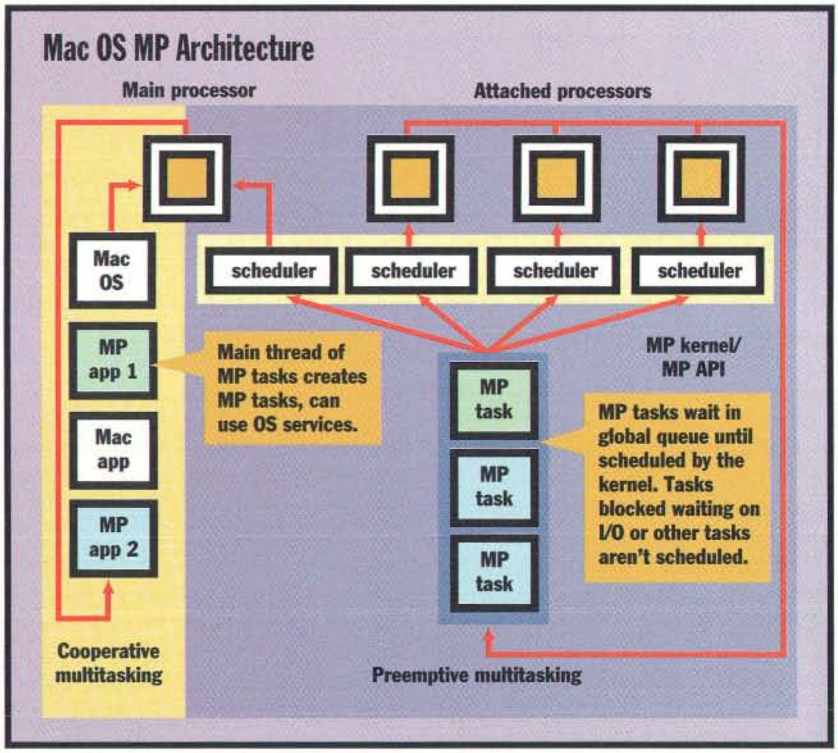
Today, desktop computer designs are flirting with clock speeds of 300 MHz, unheard of just a year ago. However, to keep a computer's design both simple and affordable, its system bus—where the memory and certain peripherals hang out—typically dawdles along at a fraction of the processor's speed. Because of the design and cost constraints, it's going to be difficult for even faster systems to realize significant gains in performance.

There's an alternative design that can achieve large performance boosts in spite of the slower bus. This is multiprocessing (MP), where the system has two or more processors that improve throughput by working in concert to divide and conquer a job. Of course, there's a catch: Some hardware modifications are necessary so the processors can properly share the system bus and the peripherals. Also, the OS software requires changes so it can operate the multiple processors. Furthermore, it may be necessary to modify the application software so it divvies a task into sections for use by the various processors.

Technical Issues Solved

MP's cost and performance advantages led Mac OS vendors to tackle these hardware and software issues. In May of 1995, Apple Computer and DayStar Digital (a Mac OS licensee and hardware designer) announced the joint development of an API, the Apple MP API, that resolved the software situation. In October 1995, DayStar addressed the hardware situation by shipping a four-processor Mac-compatible, called the Genesis MP, followed by two-processor systems in June 1996. This was followed by Apple's two-processor Power Mac 9500/MP in August. Another Mac OS vendor, UMAX, has begun shipping multiprocessor systems, too. Both Apple and UMAX have licensed MP hardware designs from DayStar.

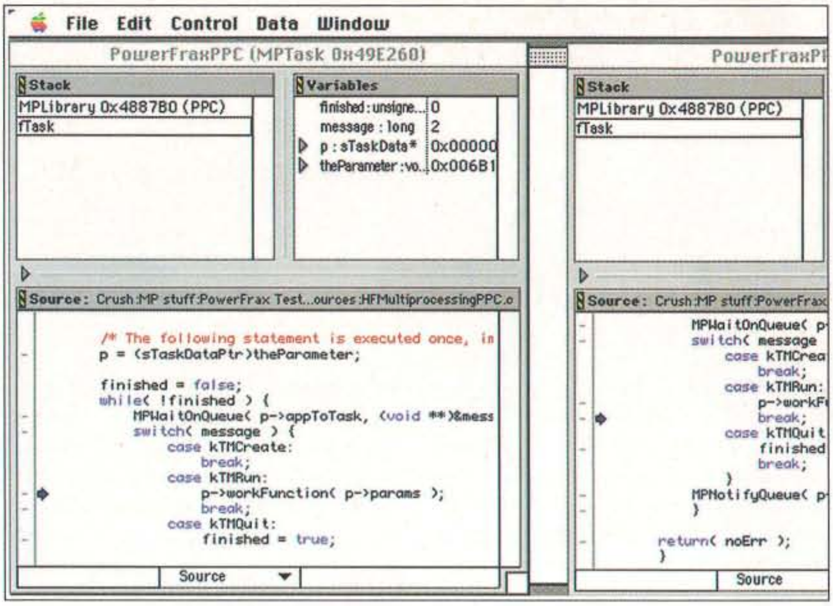
It's worth examining how DayStar and Apple dealt with some of the technical difficulties in implementing MP on a Mac OS system. For the hardware, changes to the existing system architecture to add MP support were rather small. Most of the PowerPC processor family has on-chip support for an *n*-processor MP architecture. Surprisingly, the ASICs used in the original Power Mac 9500 (introduced in 1995) had bus arbitration support for a two-processor MP design built in. Four-processor designs such as DayStar's Genesis MP require extra glue logic.



Multiprocessing tasks execute preemptively, even on a single-processor machine.

The hardware model the Apple MP API uses assumes that the processors share the same block of memory. This simplifies the software design because it makes it easy to share data and code libraries. The API also assumes a cache-coherent model, which relieves the programmer of the chore of updating the processor caches. The model assumes that only one processor needs access to I/O devices, timers, and external interrupts (although each processor can interrupt one another).

While this design's shared memory sounds like symmetric multiprocessing (SMP), it isn't. An SMP architecture assumes that everything is shared, including the I/O devices, which isn't the case with the Apple MP API. Another difference is that in an SMP system, portions of



PowerFraxPPC (MPTask 0x49E260)

```
Stack
MPLibrary 0x4887B0 (PPC)
fTask
```

```
Variables
  finished : unsigne... 0
  message : long        2
▷ p : sTaskData*        0x00000
▷ theParameter : vo...  0x006B1
```

Source: Crush:MP stuff:PowerFrax Test...ources:HFMultiprocessingPPC.o

```
      /* The following statement is executed once, in
-     p = (sTaskDataPtr)theParameter;

      finished = false;
      while( !finished ) {
-         MPWaitOnQueue( p->appToTask, (void **)&mess
-         switch( message ) {
              case kTMCreate:
                  break;
              case kTMRun:
- ◆               p->workFunction( p->params );
-                 break;
              case kTMQuit:
-                 finished = true;
```

PowerFraxPP

```
Stack
MPLibrary 0x4887B0 (PPC)
fTask
```

Source: Crush:MP stuff:PowerFrax

```
-         MPWaitOnQueue( p
-         switch( message
              case kTMCrea
                  break;
              case kTMRun:
-                 p->workF
- ◆               break;
              case kTMQuit
-                 finished
                  break;
          }
-         MPNotifyQueue( p
-     }

-     return( noErr );
  }
```

Metrowerks CodeWarrior provides source-level debugging on MP tasks.

the OS can migrate to other processors to balance the load. This isn't possible in a Mac OS MP design because much of the OS code is nonreentrant. The Apple MP API overcomes these problems by restricting what code certain processors call.

The Apple MP API

The Apple MP API consists of a shared library that implements the API functions and a hardware abstraction layer (HAL) that manages the low-level MP hardware for both the programmer and the API itself. When an MP-aware application uses MP services, the Mac OS Code Fragment Manager automatically connects it to the MP library. The MP library next locates the appropriate HAL for the given hardware configuration. The processor that's already executing code at this point is anointed as the main processor, while the other processors are designated attached processors. The main processor runs the 680x0 emulator and the Mac OS and manages device I/O. The MP API uses the HAL to bootstrap the other processors and install a lightweight preemptive scheduler on all the processors (as shown in the figure "Mac OS MP Architecture" on page 59). The MP API provides kernel services that implement MP task coordination and messaging. Note that the MP kernel isn't an executing task like a daemon; it is simply a set of service calls.

The Apple MP API provides calls that query the system for the number of processors, create/terminate MP tasks, allocate memory, and manage task synchronization. When an application creates an MP task, the MP kernel assigns it to a global task queue. When a currently executing task gets rescheduled, the processor's scheduler checks this queue and runs the next pending MP task for a maximum interval of 10 milliseconds. This permits the kernel to perform load-balancing for MP tasks. Task coordination is accomplished through supplied queue, semaphore, and critical region API calls. You should use these calls, since they help the kernel schedule and control MP tasks. Because the main processor also runs a scheduler and executes MP tasks, the Apple MP API performs symmetric processing even if the OS doesn't.

MP Limits

When writing a Mac application to use MP tasks, keep in mind the Apple MP API's limitations. First, an MP task can't execute 680x0 processor code. That's because the 680x0 emulator runs only on the main processor. Also, an MP task can't make direct calls to the Mac OS or Toolbox because of the nonreentrant code problem and because some of these functions consist of 680x0 code. This also explains why the main processor handles all the I/O: The File Manager and certain low-level I/O code use 680x0 code.

From these restrictions, it becomes obvious that MP tasks are most suitable for PowerPC compute-intensive code. Fortunately, a lot of work, such as image editing, digital video effects, 3-D modeling, and simulation, fit into this category. Furthermore, an MP-aware application isn't locked out of using the OS. The application's main task executes on the main processor and can avail itself of OS services. The MP tasks executing on the attached processors would use the synchronization calls to notify the main task when data should, say, be spooled to disk or placed on the screen.

It's up to you to determine how to best partition the job so that MP tasks make the best use of system resources. Ideally, you want each MP task accessing memory at different times to make the most efficient use of the system bus. To help in this area, version 11 of Metrowerks CodeWarrior provides source-level debugging of MP tasks (as shown in the screenshot). While this involves some extra work on your part, the results can make the effort worthwhile: On a four-processor system, the performance of MP applications can be boosted by 2.5 to 3.5 times. Despite the formidable limits placed upon the MP architecture by the Mac OS, the Apple MP API offers a practical MP solution. It's important to know that Apple plans to carry over the MP API into future versions of the Mac operating system. This will preserve your MP coding efforts and will provide better performance because these future releases will offer OS-level support for symmetric multiprocessing. **B**

The author thanks David Sowell, Chris Cooksey, and David Methven of DayStar Digital for their help with this article.

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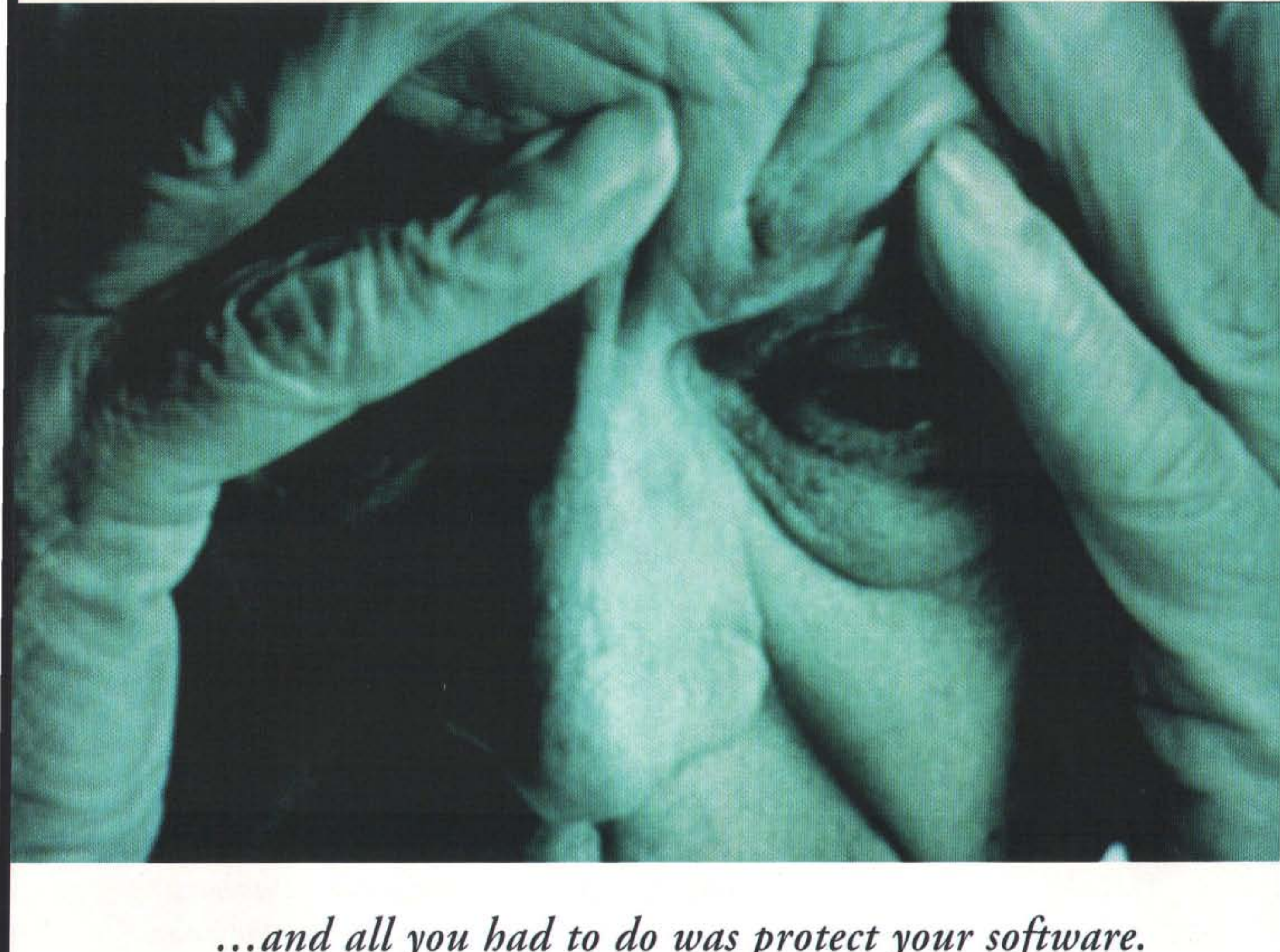

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This language can handle simple scripting jobs or build large OOP libraries. ***By Jeffrey P. Shell***

Python Does Scripts and Objects

py·thon \ˈpi-ˌthän\ *n* (1836) 1 : a large constricting snake 2 *cap* : short for the British comedy troupe "Monty Python's Flying Circus" 3 *cap* : a powerful modern object-oriented-programming (OOP) language

Python, the third definition in the fictional dictionary entry, is an ideal language for many of today's computing tasks. It's been used to build client/server databases and Unix system administration tools, create Common Gateway Interface (CGI) scripts, embed objects, and facilitate rapid applications prototyping. Its dynamic range and variety of hooks make it suitable across many boundaries where one programming language halts and another is needed. Incidentally, the name Python derives from the second dictionary definition, not the constricting snake of definition one—although as a programming language, Python is able to "coil" itself around a variety of platforms. That's because, like many of the new programming languages today, Python compiles to neutral byte code.

Unlike Java, however, this compilation happens on the fly, as modules are imported into the Python interpreter. The interpreter performs automatic version checks against the source code file's modification date and fetches the most recently generated byte-code file. The version-control process is almost invisible to the programmer and is evident only when a triggered compilation slows the launching of a program.

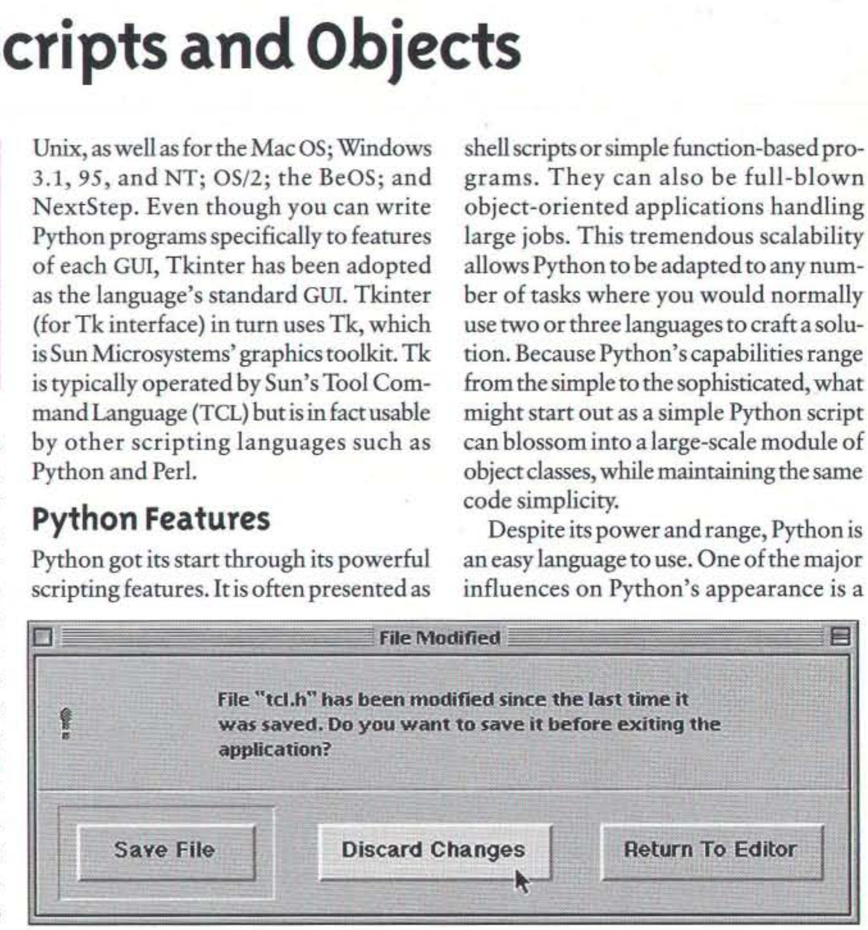
Python offers strong interplatform operability. A majority of Python programs written on one platform can run effortlessly on another. Python implementations exist for almost all flavors of Unix, as well as for the Mac OS; Windows 3.1, 95, and NT; OS/2; the BeOS; and NextStep. Even though you can write Python programs specifically to features of each GUI, Tkinter has been adopted as the language's standard GUI. Tkinter (for Tk interface) in turn uses Tk, which is Sun Microsystems' graphics toolkit. Tk is typically operated by Sun's Tool Command Language (TCL) but is in fact usable by other scripting languages such as Python and Perl.

Python Features

Python got its start through its powerful scripting features. It is often presented as a bridge between Unix shell programming and C programming. That is, Python is ideal for projects that are too complex for the normal shell tools to handle, but not so complex that they are worth writing in C or C++. Because Python is a very high-level language, it provides the programmer with complex data types unavailable in shell scripts or programming languages, such as dictionaries (associative arrays). System-administration scripts, mailing-list automation, and other sophisticated tasks can often be written using relatively little code.

Another of Python's strengths is that it is scalable. Python programs can be short shell scripts or simple function-based programs. They can also be full-blown object-oriented applications handling large jobs. This tremendous scalability allows Python to be adapted to any number of tasks where you would normally use two or three languages to craft a solution. Because Python's capabilities range from the simple to the sophisticated, what might start out as a simple Python script can blossom into a large-scale module of object classes, while maintaining the same code simplicity.

Despite its power and range, Python is an easy language to use. One of the major influences on Python's appearance is a smaller language called ABC. ABC was designed as a more modern BASIC, providing some high-level data types in a small, robust language. Like BASIC, ABC was constructed as a teaching language and has many nice touches for programming simplicity. These same features appear in Python. For example, Python has no `begin` and `end` statements or braces. Code grouping is done through indentation, and the Newline character acts as a command separator. A command can sprawl over many lines if necessary, or multiple commands can fit on one line. This format practically forces good programming style, which in turn produces



File "tcl.h" has been modified since the last time it was saved. Do you want to save it before exiting the application?

Python uses Sun's standard Tkinter GUI so that programs can execute on many platforms.

neat, maintainable code while conserving space. Most seasoned programmers converting to Python are surprised by this at first, but they soon grow used to the freedom it brings. See "Operator Overloading in Python" for an example.

Python is an easily extendable language. The core of Python is written in C, and the source code is freely available, along with a complete API for extending the language. This lets you boost the speed of a commonly used function or hook Python byte-code files to large, already-made binaries such as imaging libraries or to platform-specific APIs like Microsoft Foundation Classes (MFC) or the Mac OS Toolbox.

Having grown up in the age of the Internet, Python comes standard with many modules that implement objects for use with most TCP protocols. These Internet-savvy modules enable Python to implement easy Web-site maintenance and administration programs, and they allow you to write smart agents and implement many other server tasks. Python can be both server and client. On the server side, Python can process HTTP requests, filter incoming messages and mail, access large databases, perform as a CGI script, be embedded in Hypertext Markup Language (HTML) if the server allows it, or serve up its own objects. On the client side (especially through use of Tkinter), Python can be a client for any TCP format, including HTML. It can also transmit objects over the network to other Python servers/clients or exist as a platform-neutral database front end, which makes it a great intranet asset.

Because of its scriptlike nature, Python is a natural as an embedded language inside large compiled programs such as databases, multimedia applications, groupware environments, virtual worlds (both text and 3-D), and HTML documents.

Python at a Glance

- Cross-platform: It uses Sun's Tkinter as the GUI and generates machine-indepedent byte code.
- Scalable: It can implement simple shell scripts or build complex object-oriented libraries.
- Extendable: It can hook directly into other binaries such as the Microsoft Foundation Classes (MFC) library or the Mac OS Toolbox.
- Embeddable: Because of its script-like nature, it can be embedded in HTML, groupware environments, and databases.

In terms of security and today's concern with distributed Internet applications, Java definitely excels. Because Python is more of a scripting language, it can have lots of freedom with the local file system, which creates security risks. Furthermore, Python allows many ways to dynamically invoke commands read from any file type, even a TCP socket. Python does have a restricted mode that "fakes" many of the standard functions and modules but actually uses only those deemed "safe." If an attempt is made by the code to access restricted material, an error is raised and the user is alerted.

For a programming language, Python is flexible. Classes and method references in Python are treated as first-class objects. That is, new methods and member variables can be added to a class at any time, and all existing and future instances of classes are affected by these changes. This way, a scheduled event on a server program can change a variable in the class definition that defines each user's privileges. Thus, when standard office hours end, access could be broadened automatically to certain users with a single line of code such as `userClass.restrictions=3`. All existing and future instances of `userClass` are updated and use this new value until the class variable is changed again. A programmer maintaining the code for the server could log in and be allowed to add or update classes and methods without having to take the server down. Python is also a language of "nothing but hooks." A programmer has hooks into almost every aspect of the system and can read or overload these attributes to further customize their code.

Ready to Slither

The standard distributions of Python have over 120 ready-made modules, including Internet libraries, cryptography, various DBM implementations, regular expression and string handling, text formatting, math, file handling (including full Posix file handling), code profiling and debugging, object persistence and storing, and Tkinter. Often included in these distributions are many demonstrations of Python's use for client/server applications, Web serving, and embedding. Also available are free modules for use with SQL and other databases, and an extended version of Python called Numerical Python, which allows for fast, high-level math constructs. The Mac OS version includes support for the Mac Toolbox and Apple Events. It can create AppleScript-style applets on CFM-capable and PowerPC machines. The Windows version allows use of MFC and has a Netscape plug-in to run Python applets. An ActiveX/Explorer interface and an OpenDoc container are currently in the works. Support for Silicon Graphics' GL and Sun's Audio Device is also standard, making Python ready to use right out of the box.

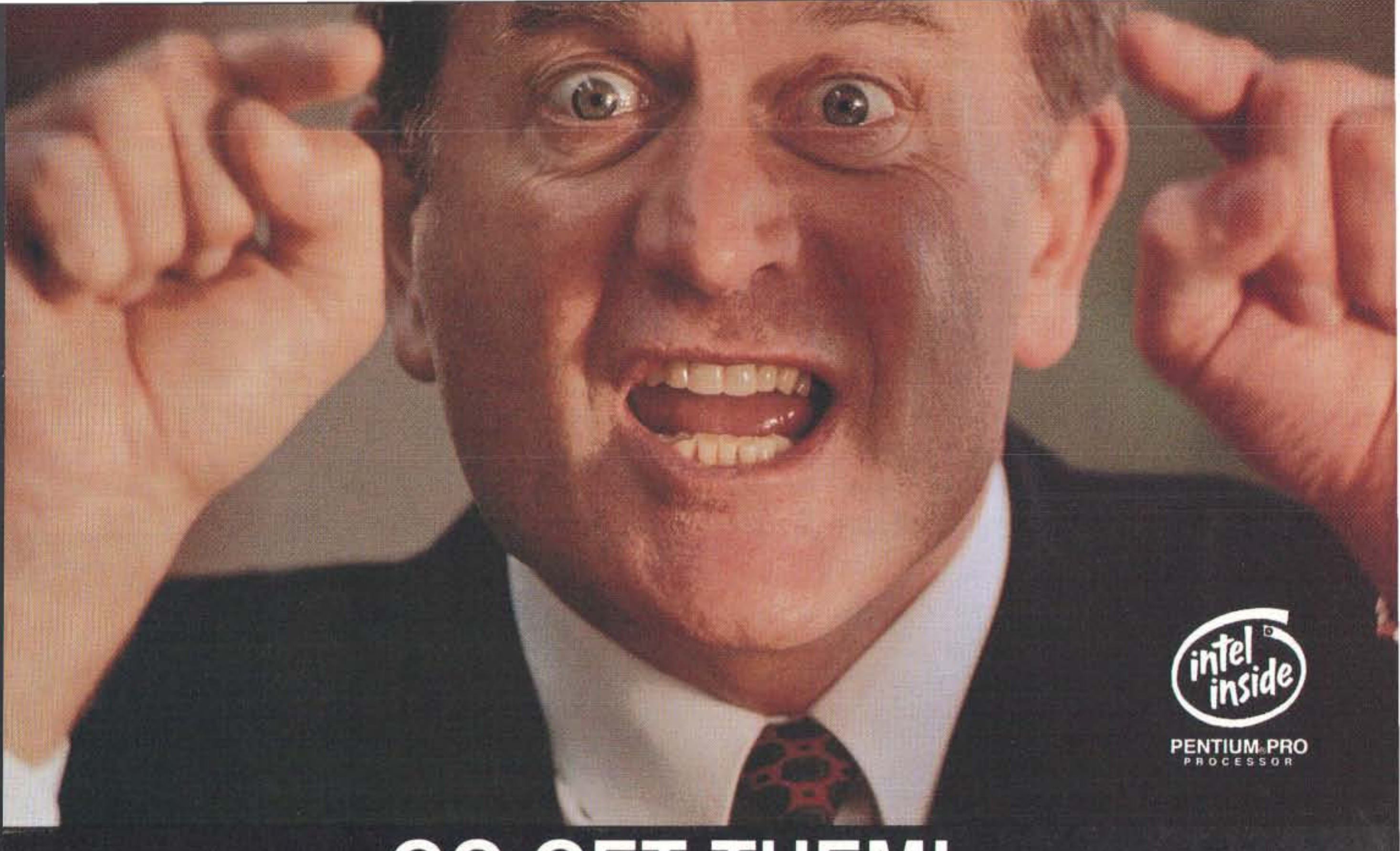
Operator Overloading in Python

```
import string
class addSquare:
 def __init__(self,value=1):
   self.value = value
 def __add__(self,other):
   if type(other) ==
type("abc"):
    other = string.atof(other)
   return self.value**2 +
other**2
 __radd__ = __add__
```

A simple class with operator overloading example in Python. __add__(self,other) overloads the + symbol when an instance of addSquare is on the left. __radd__ overloads the + symbol when the instance is on the right. The __add__ method checks the other object being added, and if it's a string, it converts it to a floating point. The class adds the squares of the two objects. (the "__" denotes special methods).

Python is available completely as freeware, made possible by contributions to the Python Software Activity (PSA), a legitimate organization whose proceeds support Python financially. A growing fleet of volunteers and special-interest groups (SIGs) help in maintaining Python code and extending it into new platforms and fields, making Python a nearly universal solution to most programming problems. You can access the Internet at http://www.python.org and comp.lang.python for complete information about Python. B

Jeffrey P. Shell is in charge of object technologies and Python programming at Cynapses. He can be reached at **jeff@cynapses.com**.



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Your E-Mail Is OBSOLETE

Internet-based messaging promises new cures for enterprise e-mail blues, but is it ready for your business?

By Michael Nadeau

E-mail has grown from a mere convenience to a mission-critical application. It's the backbone for collecting and disseminating corporate information and for crucial communications both within and outside a company. For many businesses, it's also a mess.

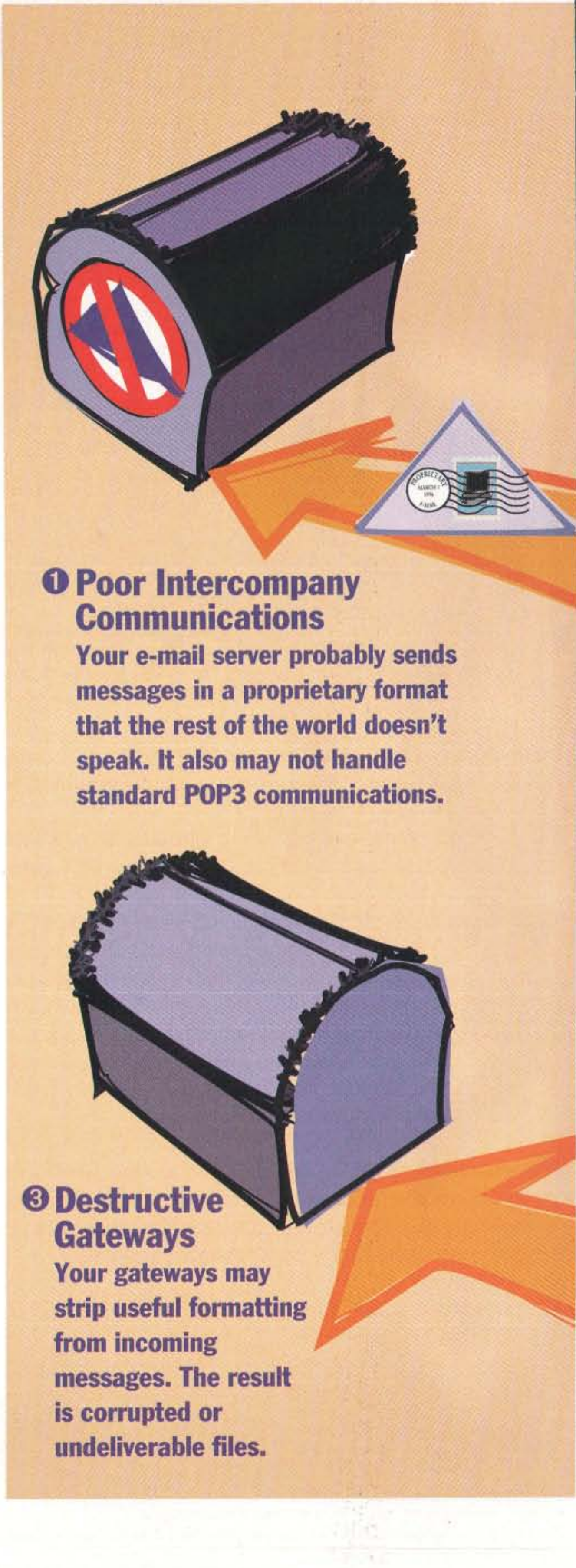
Some companies have as many as five or six different e-mail systems, each with its own proprietary protocols and formats. This can be an expensive administrative nightmare, but, more important, it is an enormous barrier to exchanging, archiving, and retrieving vital corporate information.

Salvation may be within reach, thanks to e-mail systems based on Internet standards. The core Internet protocols provide a lowest-common-denominator environment for sending key messaging functions across different e-mail architectures while opening the door to communicating with the outside world.

Right from the start, the Internet was built for large-scale implementations. Its proven family of protocols lets you send and receive e-mail to or from anyone with an IP connection. SMTP has proven its messaging reliability over almost two decades. Post Office Protocol (POP) and Internet Message Access Protocol (IMAP) both handle message retrieval, and the latest version of IMAP lets you review messages and attachments before downloading them. You can leave entire messages, or parts of messages, on the server for easier archiving and sharing of messages. Application Configuration Access Protocol (ACAP), an evolving standard, will let you create address books, user options, and other data for universal access. Finally, Lightweight Directory Access Protocol (LDAP) provides a structure for small, fast, and easy-to-implement clients.

The result? If you use e-mail only for messaging, the benefits of Internet e-mail are ready for you to use today. Even more important in the long run, Internet e-mail will be the basis for new types of collaborative applications.

However, there are trade-offs if you commit to Internet e-



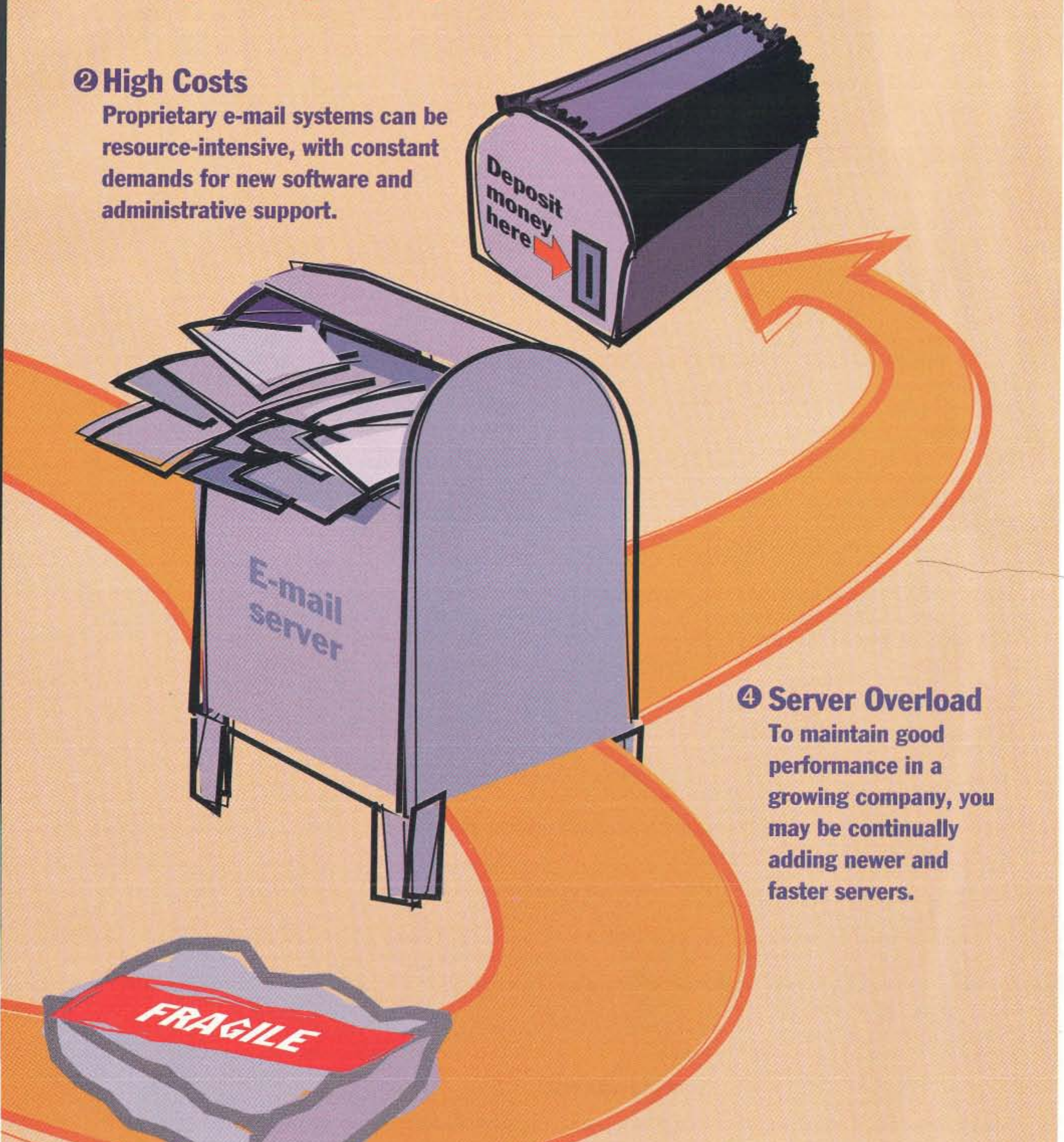
❶ Poor Intercompany Communications

Your e-mail server probably sends messages in a proprietary format that the rest of the world doesn't speak. It also may not handle standard POP3 communications.

❸ Destructive Gateways

Your gateways may strip useful formatting from incoming messages. The result is corrupted or undeliverable files.

Four Ways Proprietary E-Mail Stumbles



❷ High Costs

Proprietary e-mail systems can be resource-intensive, with constant demands for new software and administrative support.

❹ Server Overload

To maintain good performance in a growing company, you may be continually adding newer and faster servers.

mail today. Key features of proprietary mail systems, such as group scheduling and calendaring, are still unproven. Also, Internet e-mail doesn't tell you when or if a message is delivered or provide a guaranteed delivery time. If you rely on these capabilities, Internet e-mail will probably disappoint you.

Whether you're willing to make the plunge to Internet e-mail today or you're making plans for the future, here are some key considerations for making the transition as smooth as possible.

Integrated Messaging

Messaging is at the heart of any enterprise network, and the Internet, with its ubiquitous presence and common standards, can be the obvious messaging solution, especially for unifying and reducing the number of disparate systems you operate. Furthermore, Internet messaging opens up communication with business contacts outside the enterprise.

Some companies, mostly small businesses with few legacy systems, are adopting a pure Internet solution. Most businesses, however, can't just throw out their old messaging systems. Their features, plus the investments in equipment, training, and other resources, ensure the continued use of legacy messaging systems for the foreseeable future. The trick, then, is to integrate Internet messaging with the proprietary systems in a way that maximizes the benefits of both. (See the figures on page 69 for a comparison of the different architectures; see the text box "Managing Multiple Messengers" on page 76 for an example.)

Indeed, Internet support may be available even if companies aren't looking for it. Companies that want to stick with software they have today will be able to do so, because even if they buy a solution from a proprietary system vendor, the protocol support and administration tools, including directory synchronization, will likely be there. Some vendors do not yet support the latest Internet protocols, such as IMAP4, but virtually all are expected to by the end of this quarter. (See the text box "Internet Standards" on page 72.)

Therefore, companies that want to move slowly into an Internet messaging system can do so through their current suppliers. Those that want to be more aggressive can buy a pure Internet system and maintain interoperability for basic functions with legacy systems.

Internet vs. Proprietary Messaging

Who Has the Edge?

	Internet	Proprietary
Scalability	**The Internet was designed for very-large-scale implementation.**	Varies from product to product, but generally requires additional server and administrative support.
Features	While possible to implement features commonly found on proprietary systems, standards are not complete.	**Key features, such as group scheduling, are field proven and highly integrated into the messaging environment.**
Administration tools	Solid tools just beginning to appear.	**Competition and years of revisions make for robust options.**
Reliability	No control over route of message or means of verifying delivery.	**Provides notification of delivery and guaranteed delivery time.**
Choice of clients	**Uses any POP3 client.**	Some, but not all, allow choice of POP3-compliant clients.
Cost to own	**Requires less server and administrative support.**	Requires more servers and administrative support, but varies from product to product.
Proven track record	Key standards and products are new to market.	**Years of in-the-field use.**
External communications	**Can send and receive e-mail to or from anyone with an IP connection.**	Key vendors have either partially or fully implemented ability to send and receive messages over an IP connection.
Message integrity*	**Attachments and commonly used formats arrive intact.**	Attachments must be converted at a gateway server–a potential point of failure.
Performance	Variable delivery time.	**Can guarantee delivery (or notify failures) within a matter of seconds.**
Security	Standards not yet finished.	**Relatively high level of security within the network.**

*The ability to retain message formatting and structure.

As companies rush to build intranets, they themselves provide TCP/IP connectivity to their networks and to their employees' desktops. But changing infrastructure takes time. Assuming the infrastructure is in place, however, three key issues emerge for adopting an Internet-based e-mail system: standards, cost, and flexibility.

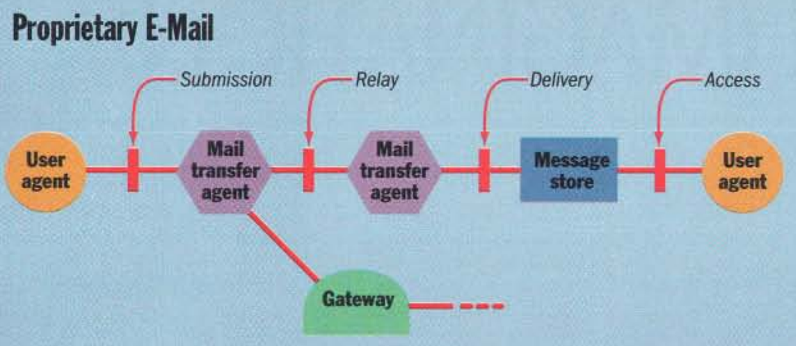
The Standards

Every system, on both the server and client side, must have a common language for data transmission and retrieval, popular file formats, directory services, security, and certain added features. Here, the Internet is strong because its standards are widely available and in some case have been used longer than proprietary standards.

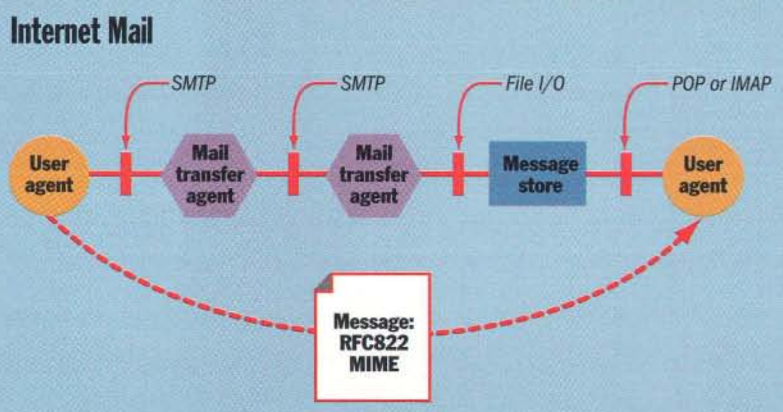
As a result, the leading proprietary messaging systems, such as Lotus's Notes and Microsoft Exchange, already have integrated the basic Internet protocols into their products or will do so shortly. Novell, with Groupwise 5, has adopted Internet standards as the native platform. (On the other hand, pure Internet messaging products, like Software.com's Post.Office and Netscape Communications' SuiteSpot, work with proprietary systems because they also natively support established interoperability standards such as X.400 and MAPI.)

Vendors either implement Internet

Although the structures appear similar, proprietary mail architectures must use gateways to convert messages to their own formats.



Basic message-handling systems all include a means of submission, one or more points of relay, and a message store for user access.



On the Internet, submission and transfer use SMTP protocols, while POP or IMAP protocols handle user access to the message store.

standards natively, as Novell does, or by conversion through a gateway, in the manner of Microsoft or Lotus. In both cases, the commitment is strong. "[Support of Internet standards] is a core component of cc:Mail moving forward," according to Mike Maier, a cc:Mail product manager at Lotus.

The Costs

The cost of Internet e-mail is closely tied to scalability. As the number of users and locations with e-mail implementations increases, what happens to your hardware and software costs? Will you need more servers and more people to administer your system? Here again, the Internet crowd claims an advantage that proprietary-systems vendors refute.

In a typical proprietary system, a server can support a given number of people and features. Internet messaging is much more scalable. "The Internet is already larger than what anyone's enterprise has to deal with," notes Kevin Carosso, vice president of engineering at e-mail and fax-software vendor Innosoft (West Covina, CA). This scalability especially pays off when a company extends messaging services to a remote location. Often, an IP connection is all that's required at the remote end; the headquarters server can handle the internal management.

Proprietary vendors argue that to provide equivalent functionality—scheduling, for instance—Internet systems would require extra servers, too. However, Internet messaging is more flexible about where a company places its servers.

Cost was the main reason that consulting firm Pyramid Solutions (Troy, MI) chose Ipswitch's IMail Server over Microsoft Exchange. This small company started out with Microsoft Mail. As employees connected to the Internet, "switching to a pure Internet system made more sense for us," says senior systems engineer Jerry Palardy.

Pyramid has 50 employees in two offices and in several customer locations. The Microsoft solution would have required servers at the remote locations and cost about $7000. The Internet mail server cost $700 and was installed on hardware already in place. Palardy says the company is happy with the system, but acknowledges that Exchange might have made more sense if Pyramid were a larger company.

The administrative overhead generally is less with an Internet system because proprietary systems must duplicate some of the services that are already in the Internet infrastructure. Tasks associated with maintaining a message store in a proprietary system, such as archiving and compressing the data, are not necessary in an Internet environment.

On the other hand, in environments with multiple messaging systems, adding administration tools for each to a proprietary system is somewhat more complex. Vendors of proprietary systems have a well-developed arsenal of tools to ease the administrative tasks, while only recently has there been any reasonably good software to manage Internet messaging. Still, Internet messaging shows real promise that it can reduce a company's messaging overhead costs.

One Size Doesn't Fit All

Vendors of messaging products have to consider two different constituencies within an organization: the users and the people who manage the system. Both want choices in the products they use, and the solutions for both must be in sync.

A company might standardize on one or two messaging architectures, but it would be impractical, if not impossible, to require all employees to use the same messaging client. People work in different environments, depending on their jobs. A salesperson, for example, might spend

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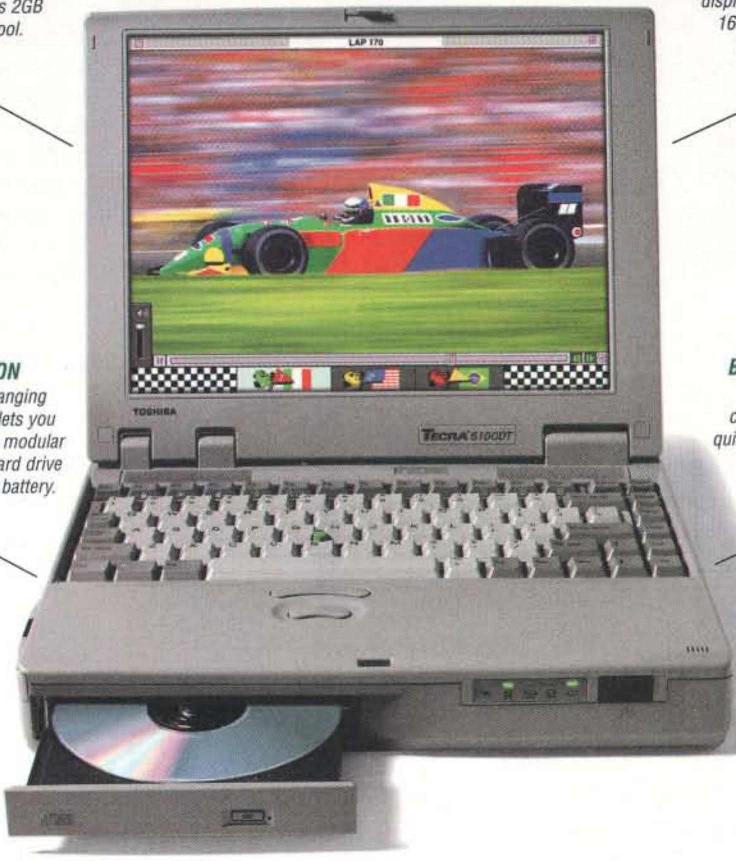

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Internet Standards

The Internet was set up for messaging, so messaging standards lie at its very heart. These standards evolve to accommodate new tasks users want to perform, and to simplify interfacing applications with the Internet.

TCP/IP and SMTP

The core Internet transmission protocol is TCP/IP, which carries all Internet traffic. Mail traffic has its own protocol, SMTP, which supports only the rudimentary text format. Still, this standard has worked reliably for about 18 years and has been supported by virtually every major messaging system. The figure below shows the basic model for SMTP.

SMTP gets your messages only as far as the client, however, and does little else. It does not, for example, guarantee delivery, issue a return receipt, allow "unsending," or carry attachments—all common features in proprietary messaging environments. However, other Internet standards exist for these and other features.

POP and IMAP

Once a message reaches the client, two other standards come into play. Post Office Protocol (POP) and Internet Message Access Protocol (IMAP) determine how you retrieve a message. POP's latest version, POP3, is rather limited. It requires that messages be kept in a store on a server. When you want messages from this store, you have no choice but to download them all to your local system. Still, POP3 is an important link between Internet and proprietary e-mail systems because all the major vendors support it.

The latest version of IMAP, IMAP4, gives you more choices than POP3 on how to retrieve messages. With it, you can check the messages in the store before downloading them. You can then select what you want, even just part of a message, and leave the rest on the server. Messages stay there until you delete them. These features are important conveniences, but they also make it easier to archive and share messages—something proprietary systems already do well.

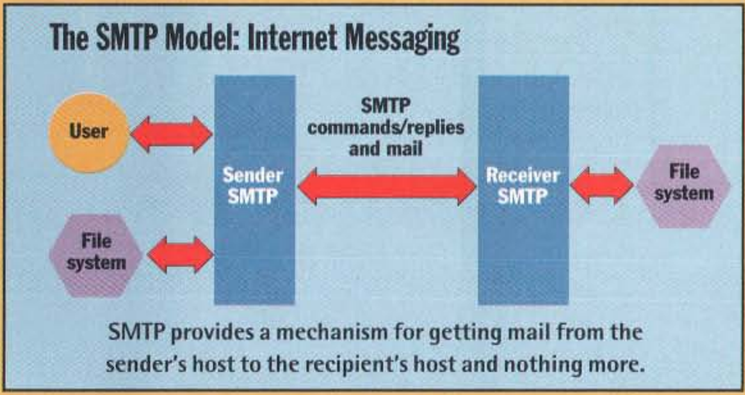
Most vendors and analysts expect that IMAP eventually will replace POP3 although they currently coexist on many implementations. (For example, Microsoft and Lotus currently support POP3 in all their messaging products and will have IMAP4 support in the first quarter of this year.) The significance here is that, as with a pure Internet e-mail system, proprietary servers like Microsoft Exchange or cc:Mail will support any POP3- or IMAP4-compliant client.

ACAP and IMSP

Beyond IMAP is Application Configuration Access Protocol (ACAP). ACAP enhances IMAP by letting you set up address books, user options, and other data for universal access. At this writing, no Internet or proprietary products have implemented ACAP because the Internet Engineering Task Force (IETF), the group responsible for developing Internet standards, has not yet approved the final specification. A final spec should be out early this year, and implementations will likely follow soon after. In the meantime, some Internet products use Internet Messaging Support Protocol (IMSP), a less robust standard than ACAP. However, IMSP will probably fade away in favor of ACAP. (For more information on POP, IMAP, and ACAP, see "E-Mail Grows Up" in the December 1996 BYTE).

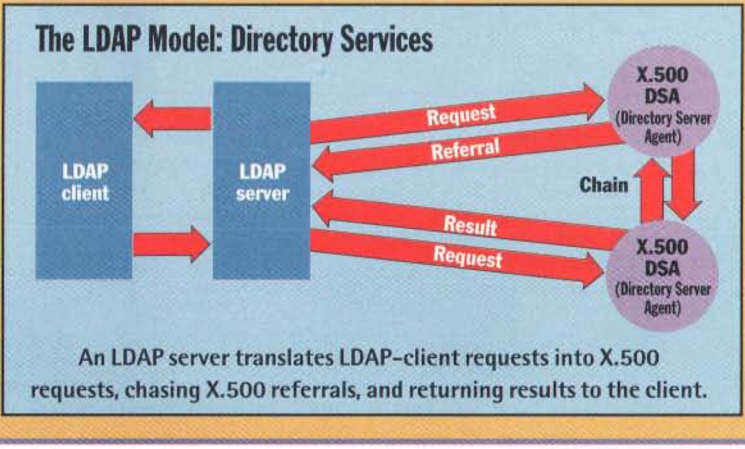
LDAP

For ACAP to do its job, it needs to work within a standard directory services structure. Lightweight Directory Access Protocol (LDAP) provides that structure. LDAP is a subset of the X.500 directory commonly used in many LANs. (See the figure below.) It runs over TCP/IP and uses a simplified data representation for protocol elements. LDAP clients are, therefore, smaller, faster, and easier to implement than X.500 clients. LDAP is vendor-independent and works with, but does not require, X.500. (See "LDAP Unites the Internet" in the December 1996 BYTE.)



The SMTP Model: Internet Messaging

SMTP provides a mechanism for getting mail from the sender's host to the recipient's host and nothing more.



The LDAP Model: Directory Services

LDAP client
LDAP server
Request
Referral
X.500 DSA (Directory Server Agent)
Chain
Result
Request
X.500 DSA (Directory Server Agent)

An LDAP server translates LDAP-client requests into X.500 requests, chasing X.500 referrals, and returning results to the client.

The Internet Standards Picture

Standard	Status
SMTP	Widely deployed
POP3	Widely deployed
IMAP4	Soon to be widely deployed
IMSP	Deployed mainly among native Internet products
ACAP	IETF spec expected late 1997
MIME	Widely deployed
S/MIME	Spec not finalized, but some implementations exist
LDAP	Widely deployed
Calendaring/ Scheduling	IETF spec expected mid-1997
Fax	IETF spec expected mid-1997
EDI	IETF spec expected late-1997
Voice	IETF spec expected mid to late 1997
Receipt Notification	IETF spec expected mid-1997

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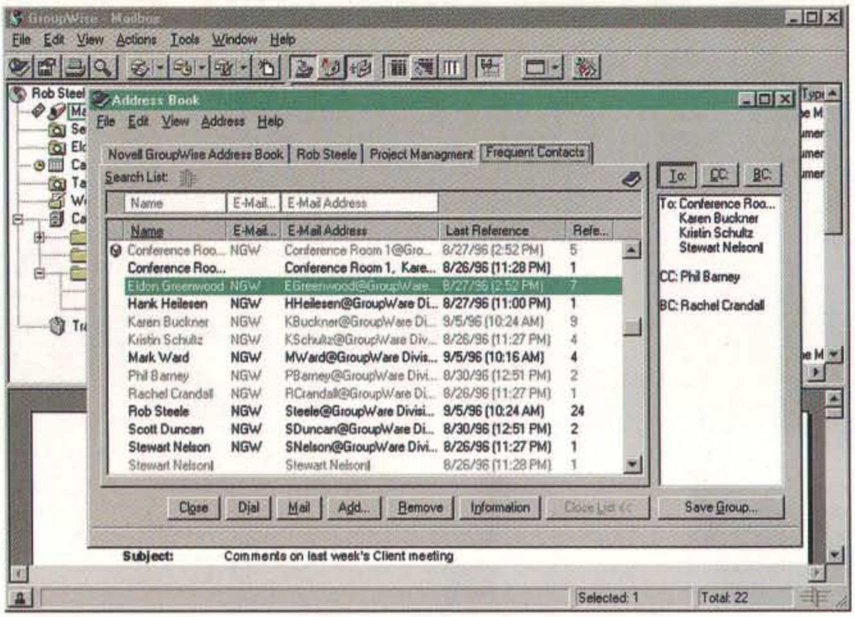
computing time in an applications suite. Other employees might only occasionally use a computer, to access the Web through a browser or check e-mail through a dedicated reader. Any Internet, proprietary, or hybrid messaging system, therefore, must support multiple types and brands of e-mail clients. Through adherence to POP3 and, eventually, IMAP4, virtually all currently available products provide this flexibility.

This was important to Jeff Luck, manager of network and support systems at Pennsylvania State University's Continuing and Distance Learning department. Three years ago, the university had no POP3 system in place, so Luck chose Microsoft Mail for his 350 mostly Mac users. He liked its user interface, directory services, and integration with other applications. The capability that let him leave messages on the server was important, too, as many people worked on multiple computers and needed access to mail from all of them.



Name	E-Mail...	E-Mail Address	Last Reference	Refe...
Conference Roo...	NGW	Conference Room 1@Gro...	8/27/96 (2:52 PM)	5
Conference Roo...		Conference Room 1, Kare...	8/26/96 (11:28 PM)	1
Eldon Greenwood	NGW	EGreenwood@GroupWare...	8/27/96 (2:52 PM)	7
Hank Heilesen	NGW	HHeilesen@GroupWare Di...	8/27/96 (11:00 PM)	1
Karen Buckner	NGW	KBuckner@GroupWare Di...	9/5/96 (10:24 AM)	9
Kristin Schultz	NGW	KSchultz@GroupWare Div...	8/26/96 (11:27 PM)	4
Mark Ward	NGW	MWard@GroupWare Divis...	9/5/96 (10:16 AM)	4
Phil Barney	NGW	PBarney@GroupWare Divi...	8/30/96 (12:51 PM)	2
Rachel Crandall	NGW	RCrandall@GroupWare Di...	8/26/96 (11:27 PM)	1
Rob Steele	NGW	Steele@GroupWare Divisi...	9/5/96 (10:24 AM)	24
Scott Duncan	NGW	SDuncan@GroupWare Di...	8/30/96 (12:51 PM)	2
Stewart Nelson	NGW	SNelson@GroupWare Divi...	8/26/96 (11:27 PM)	1
Stewart Nelsonl		Stewart Nelsonl	8/26/96 (11:28 PM)	1

To: Conference Roo...
Karen Buckner
Kristin Schultz
Stewart Nelsonl

CC: Phil Barney

BC: Rachel Crandall

Subject: Comments on last week's Client meeting

Selected: 1
Total: 22

Novell's Groupwise 5.0's universal mailbox lets you manage not just e-mail messages, but faxes, documents, and phone messages.

POP3 Flexibility

A year and a half later, the university standardized on Eudora Lite and POP3. Rather than move with the university, Luck upgraded to Quarterdeck Mail 4.0 (formerly Microsoft Mail for the Mac). According to Luck, moving to Eudora Pro would have cost three times as much. Quarterdeck Mail lets him keep all the features he has now and have POP3 access to the rest of the university system. Luck says he will consider moving to a native IMAP4 system when the university does, especially if it means handing off responsibility of the mail server for his department.

On the back end, the people managing the system want to be able to mix and match servers and tools. Someone using Innosoft's PMDF e-Mail Interconnect Internet backbone, for example, might want to integrate a Microsoft Exchange server with it.

Interoperability is not enough, however. You should be able to centrally manage the entire hybrid system, and this is where synchronization is important. You should be able to remotely configure and administer both servers and clients. Most major vendors now offer this capability, using the Web as the medium for remote administration.

Directory synchronization is critical, too. Vendors that use their own directory-services protocols, including Banyan's StreetTalk and Novell's NDS, have integrated the LDAP standard. Control Data's IntraStore Server has native X.500 support.

For some people, Internet messaging-administration tools don't stack up to those in proprietary systems. Paul Hoffman of the Internet Mail Consortium (IMC) expects the Internet to reach parity by the end of the year. Companies such as Ipswitch and Software.com now offer full

Have Your Calendar Call My Calendar

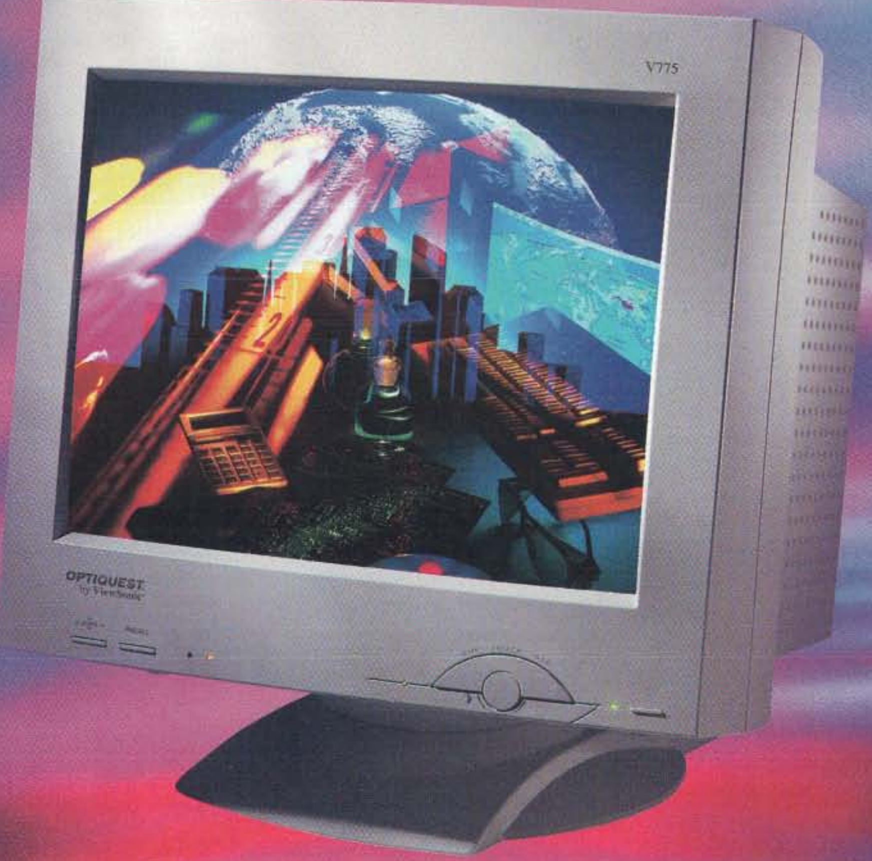
Scheduling and calendaring have existed as messaging applications for years. They are keeping millions of people tied to IBM PROFS, OfficeVision, Digital Equipment's All-in-One, and other mainframe-based systems. "Seven million OfficeVision users already have group scheduling," says Jim Burnham, director of marketing for calendaring and scheduling at Lotus. "They aren't about to move off it until similar functionality is available in client/server systems." So why is it taking so long to bring scheduling and calendaring to Internet messaging?

Lack of standards, of course. Several scheduling and calendaring applications exist for Internet messaging that adhere to the Versit vCalendar and vCard standards. But those standards cover only the most rudimentary functions—viewing a calendar and name-and-address information, respectively. To be competitive, vendors of those applications extend the standard using proprietary specifications. Therefore, scheduling meetings with clients or partners by e-mail unfortunately is not possible unless they happen to be using the same software as you. Even if you and your outside collaborators happen to be in sync today, the chances that you'll remain that way in the future are slim.

As a result, the Internet Engineering Task Force (IETF) is working to extend the Versit standards so that you can not only view the information, but actually schedule your own and other people's time. It will perform free- and busy-time searches; the specification will define a standard way to access calendaring and scheduling information from popular legacy systems.

Lotus has proposed its own Versit extensions to the IETF, called Internet Calendar Access Protocol (ICAP), and expects to demonstrate a working ICAP server by the time you read this. Microsoft, Novell, and other companies also have proposed specifications, but all promise to support whatever the IETF decides, perhaps as early as this spring.

THE CLEAR CHOICE



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suites of administration tools. Also, tools designed to handle disparate messaging systems, such as Lotus's SoftSwitch or Hewlett-Packard's OpenVision, now accommodate Internet protocols.

Messaging's Missing Links

While the Internet fulfills the basic requirements for enterprise messaging today, companies are beginning to demand features that it cannot yet deliver easily. The most significant are scheduling (the ability to access calendars and plan schedules on-line) and calendaring (the ability only to view a calendar). Mainframe and Unix-based messaging systems, such as IBM's OfficeVision and Digital Equipment's All-in-One, have offered group scheduling and calendaring for over a decade. Businesses have come to depend on this capability and are loath to give it up. Ultimately, Internet messaging must not only provide group scheduling and calendaring, but provide backward compatibility with legacy systems. You can't just strand millions of users who may lack any other migration path.

Vendors of both Internet and proprietary systems are now providing this compatibility, but on an ad hoc basis. Notable examples include Novell's Groupwise, Lotus Notes, and Microsoft Exchange. Versit is a standards-setting organization founded by Apple, AT&T, IBM, and Siemens to promote systems interoperability. The widely adopted Versit vCalendar and vCard open standards, which provide a common way to view a calendar and an address book, respectively, usually support these efforts. They do not provide a means to actually schedule meetings or other events. Similarly, group scheduling is now an integrated part of application suites, such as Microsoft Office 97 and Lotus's SmartSuite 96. They now provide integration points to the Internet and other messaging systems by way of APIs. (See the text box "Have Your Calendar Call My Calendar" on page 74.)

Coming Attractions

Other desired features include e-mail-based faxing, paging, and voice. The goal for sending fax over an IP connection is not just to save the cost of the call, but also to make it a desktop function—to make it as simple as sending an e-mail message. Paging can perform two functions: to alert someone to an important message or to notify system administrators of a problem. Voice could be in the form of an audio attachment, like VocalTec's Internet Voice Mail 3.0, or making real-time voice contact over an IP connection through the desktop interface.

All these functions are currently available for Internet messaging systems, usually as third-party add-ons. However, no formal standards exist. As a result, the recipient needs compatible functionality, or the message must carry some kind of run-time module, the method that VocalTec uses.

Committees within the Internet Engineering Task Force (IETF) are working on specifications, likely as extensions of the Multipurpose Internet Mail Extensions (MIME) format, for all these features. The table "The Internet Standards Picture" on page 72 provides estimated dates for completion. When wide-scale implementation of those standards will take effect is anyone's guess.

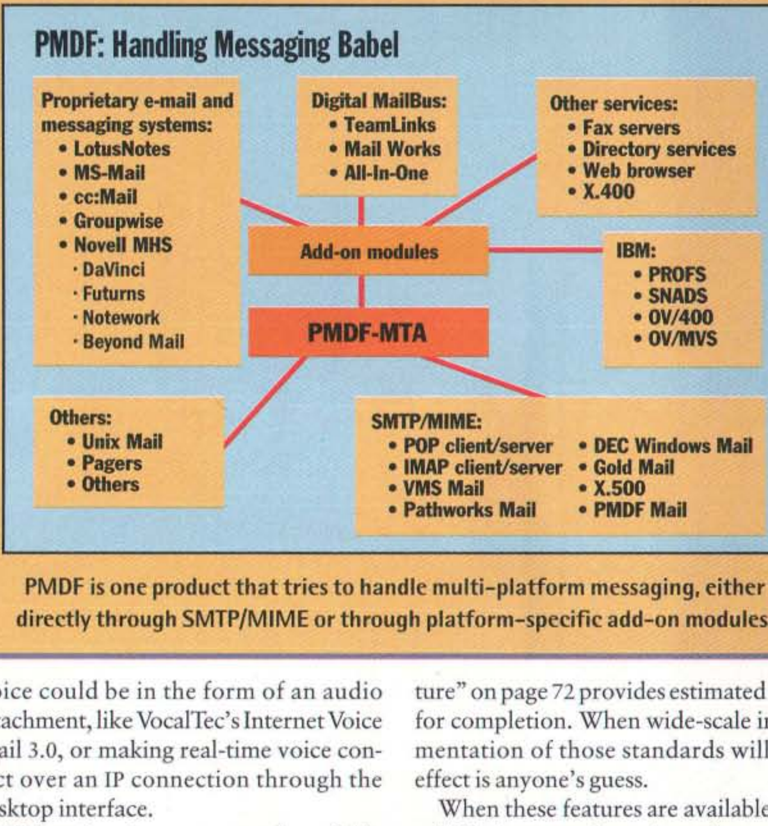
When these features are available, you will likely access them through a universal mailbox. Already available with a number of products, a universal mailbox looks a lot like an ordinary mailbox with files and folders. The difference is it can manage multiple message types. In Novell Groupwise 5, for example, users can perform document-management tasks, send a fax, schedule appointments, maintain a task list, or perform other functions through the mailbox. (See the screen on page 74.) Folders can be public or private and are accessible to people who are trav-

Managing Multiple Messengers

Derrick Ho, a manager of corporate network planning at NECis Systems Advanced Engineering department (Mountain View, CA), recently faced integrating Internet messaging with proprietary systems to maximize the benefits of both. NEC had already standardized on cc:Mail–not an ideal solution for Ho's 100-person department, many of whom depend on VMS systems. Besides, some people wanted to use Eudora to read their mail from Japan. But most worrisome to Ho was requiring two full-time people to manage the mail servers. "That is ridiculous," he says.

Ho moved his department's messaging to Innosoft's PMDF. This allowed him to get rid of separate servers for each system the department uses. Instead, PMDF provides a channel for each system. (See the figure below.) It further eases administration by simplifying modifications. Particularly troublesome was making changes to VMS's sendmail, through the obscure sendmail.cf file. "You have to be very good at hacking sendmail.cf to modify your system to your liking," says Ho. "Not very many people are able to do that."

Why didn't Ho just wait for similar capabilities from Lotus or Microsoft? "We're not going to deal with [the Lotus and Microsoft solutions] until they come out," he says. "They have to be better than PMDF."



PMDF is one product that tries to handle multi-platform messaging, either directly through SMTP/MIME or through platform-specific add-on modules.

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Security: Who's Got the Key?

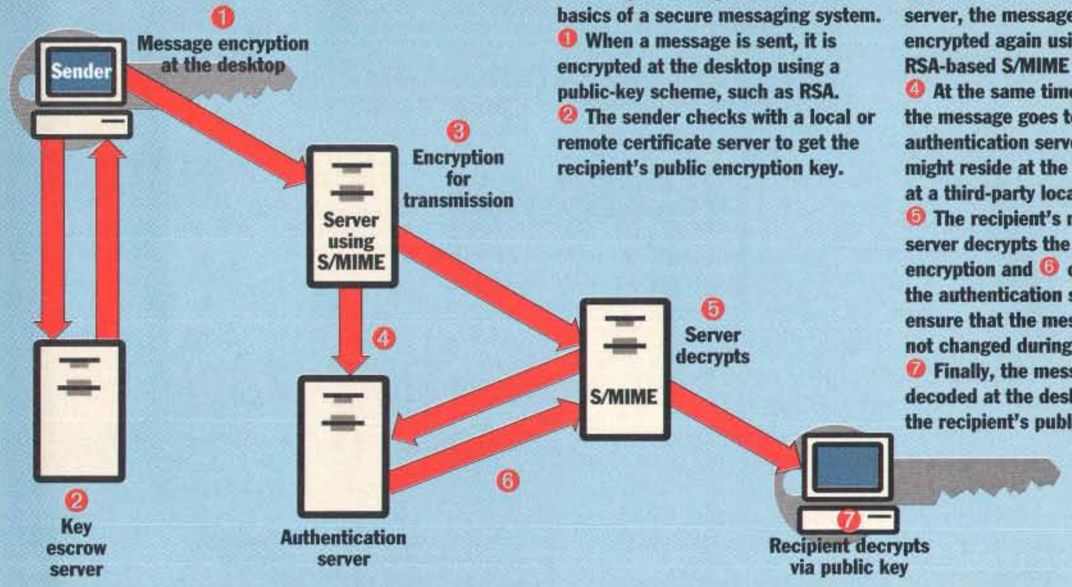
Companies must communicate with the outside world by e-mail. Yet the thought of moving company data freely to and from a company network is frightening to information technology (IT) managers. In a typical intranet, valuable company data is shielded from the outside by a firewall, which sits between the network and an externally accessible server. Nothing gets through–except e-mail.

Existing encryption schemes, such as RSA, can ensure secure transmission of data. In fact, an extension for encryption to the MIME format, S/MIME, is based on RSA and has broad industry support, but there's a catch. Encryption requires two keys, public and private. The private key encodes the message, and the public key decodes it. The recipient must have access to the public key to understand the message. (See the figure below.) The problem is how to make those keys available to only the people you want using them.

Some trusted entity must hold those keys in escrow and assign certificates that act as a digital signature, identifying users of those keys. That entity is as yet undetermined. It could be a government body, such as the U.S. Post Office, or an independent organization set up explicitly for the purpose. Verisign (Mountain View, CA) is a commercial enterprise that handles certificates. Some messaging products, such as Netscape's SuiteSpot 3.0, come with a certificate server for internal use. Third-party products, such as Nortel's Entrust, also allow companies to build internal certificate-management applications. To ensure compatibility from one certification scheme to another, companies will likely cross-certify, according to Ron Rosenthal, director of new initiatives at Harbinger Enterprise Solutions (Atlanta, GA), a vendor of electronic-commerce products and services.

The dilemma: Companies can build and manage internal certificate systems–which gives them control, but at the cost of added administrative overhead–or they can off-load that chore to a third party but lose the security of controlling the distribution of certificates. For many companies, neither choice is satisfactory.

Messaging Security


①
Message encryption at the desktop
Sender
③
Encryption for transmission
Server using S/MIME
④
②
Key escrow server
Authentication server
⑤
Server decrypts
S/MIME
⑥
⑦
Recipient decrypts via public key

This simplified diagram shows the basics of a secure messaging system. ① When a message is sent, it is encrypted at the desktop using a public-key scheme, such as RSA. ② The sender checks with a local or remote certificate server to get the recipient's public encryption key. ③ At the sender's messaging server, the message is encrypted again using, say, the RSA-based S/MIME protocol. ④ At the same time, a copy of the message goes to an authentication server, which might reside at the sender's or at a third-party location. ⑤ The recipient's messaging server decrypts the S/MIME encryption and ⑥ checks with the authentication server to ensure that the message has not changed during transit. ⑦ Finally, the message is decoded at the desktop using the recipient's public key.

eling or working from a remote location.

Another area that is generating interest in some quarters is Electronic Data Interchange (EDI). This is a common way for businesses to perform purchasing transactions and is usually done over a secure, dedicated link. The ability to carry on EDI transactions through Internet messaging and the Web could dramatically reduce the required overhead. Instead of conducting on-line transactions with just the most important suppliers and customers, a company could do so with most of them. Some companies are now accomplishing EDI over the Internet using proprietary software from vendors such as Harbinger. A standard specification is due from the IETF sometime this year.

But lack of a standard protocol is not the major barrier to Internet-based EDI. Because of the sensitive data and large size of transactions, security must be tight. The technology exists for encrypting data and authenticating people, but practical issues, such as managing certificates (to verify identities) and encryption keys (to decrypt messages), are unresolved. (See the text box above, "Security: Who's Got the Key?")

What to Do?

Describing the move to intranets and Internet-standards-based messaging as a mad rush would be only slightly hyperbolic. The benefits of lower overhead and universal communications, not to mention the greater choice of products, are quite compelling.

However, most businesses are not quite ready to embrace Internet messaging. Reluctance to give up something that they know works for something with a relatively short track record is part of the reason. The greater hurdle remains the lack of standards for mission-critical applications, such as scheduling/calendaring or document management. Standards for most of these features should be in place by the end of the year, but

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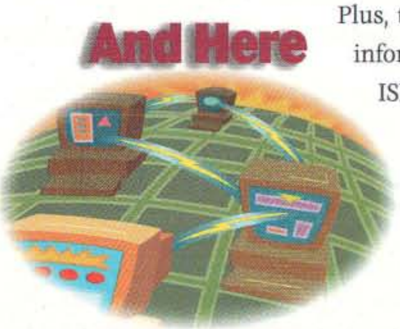

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Gateway Hell

E-mail isn't just text. Attachments such as images, application-specific files, or even videos are common. Proprietary mail systems have their own ways to accommodate common file types and provide a means to build compatibility with other types, through Mail Application Programming Interface (MAPI). MAPI in itself, however, is not a protocol standard. That, and the fact that it is controlled by a single company, Microsoft, makes some companies nervous. "MAPI is being downplayed to a tremendous extent," says John McFarlane, Software.com CEO.

By contrast, the Internet has Multipurpose Internet Mail Extensions (MIME), a standard way to represent document formats so that all Internet clients, including both browsers and mail readers, can recognize them. Each MIME type is identified by its extension, such as .txt for text or .html for Hypertext Markup Language (HTML). MIME currently covers a wide range of formats, or Internet Media Types, including Microsoft Word, Unix tar, QuickTime, ZIP, PostScript, RealAudio, and Macintosh PICT.

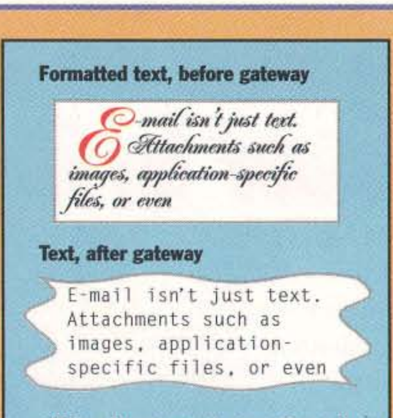
Proprietary messaging systems can and do support MIME. However, the MIME attachments must go through a conversion process at a server gateway, and this is a controversial point between Internet and proprietary messaging advocates. "Gateways are designed to lose information," says Paul Hoffman, director of the Internet Mail Consortium. The proprietary side claims that gateways are relatively sound–as long as they are "properly configured."

Barbarians at the Gate

When a MIME attachment hits a gateway, the gateway determines its type and automatically converts the document to the appropriate equivalent format. The conversion also strips out data deemed unnecessary. If the gateway makes a mistake, however, the recipient of that document has no way of recovering that message, other than to ask the sender to deliver it by some other means. Even if the attachment converts properly, it could lose its structure. For instance, you might send a snazzy-looking Word document with handsome fonts and a carefully planned format as an attachment, only to have the recipient see it as a block of regular text. "Structure is information, too," says Hoffman.

Hoffman admits that a well-designed gateway will lose only unimportant data. However, you still have to depend on gateway integrity with proprietary systems. This potential point of failure does not exist with pure Internet messaging.

But sending attachments by an all-Internet route is not bulletproof, either. Because of the Internet's distributed nature, each message travels through a number of different servers before reaching its destination. Neither the sender nor the receiver has control over those servers, any of which is capable of introducing errors or losing data. The Internet architecture also makes it difficult to guarantee a maximum time for a message to reach its destination–a necessity for some companies. "Guaranteed delivery is the most fundamental thing an e-mail system must do," says Scott Welch, president of e-mail vendor SoftArc.



Formatted text, before gateway

E-mail isn't just text. Attachments such as images, application-specific files, or even

Text, after gateway

E-mail isn't just text. Attachments such as images, application-specific files, or even

When items must pass through a gateway, the gateway may strip out formatting from the original.

Legacy Roadblocks

Mainframe-based legacy systems, such as IBM's OfficeVision, are more problematic in the way they handle attachments. They usually treat attachments as disconnected routable files that require recipients to manually seek and retrieve them. Companies such as Lotus, Digital Equipment, and Innosoft offer gateway products from systems such as PROFS or VMS Mail, but that adds complexity. Converting addresses from, say, Digital's limited two-part format to an Internet equivalent can be tricky.

It is conceivable that attachments could become irrelevant. Using Java or ActiveX scripts, it is possible to embed special data types within the body of a mail message. In fact, this feature is available now in Coordinate.com's BeyondMail 3.0. It allows you to send multimedia elements as ActiveX scripts. For now, however, this capability itself is proprietary. Netscape is talking up the benefits of sending Java applets by mail. And last November, Lotus demonstrated a cc:Mail prototype written entirely in Java. It was just a "proof of concept," but Mark McHarry, press-relations manager at Lotus Development, says "that is the future for us."

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widespread implementation will take longer.

What should you do today? Small companies with little legacy overhead are free to choose any path that meets their cost, feature, and scalability needs. As long as these companies require only basic messaging capabilities, Internet e-mail may be the best choice. By year's end, there will likely be standards that address missing elements in Internet messaging.

Managers for departments or divisions within larger companies should be aware of corporate-messaging planning. Choosing a compatible path could save effort, money, and headaches.

For larger companies, the issue is largely one of pulling together disparate systems and providing e-mail access to the outside world with minimal upheaval for users and administrators alike. Fortunately, this is doable now. Building from either proprietary or standards-based backbones, companies can ensure universal e-mail access and choice in both client software and administrative tools. What is not possible at this time is to duplicate the reliability, performance, and feature sets of established proprietary messaging systems in an all-native-Internet environment.

In any implementation where reliability or security is of the utmost concern, proprietary systems that use a standard dedicated phone connection rather than the distributed Internet infrastructure are still the safest bet. Internet messaging will eventually catch up to proprietary systems' reliability and security, but parity is at least a year away.

Still, the day when all enterprise messaging is based on Internet standards seems inevitable. "I would be surprised if by the turn of the century both Lotus and Microsoft weren't [natively] SMTP-based," says the IMC's Hoffman. Those two companies say that they'll do what their customers want. What those customers are saying is clear: Moving to Internet messaging is not a question of if—it's a question of when. **B**

Michael Nadeau, a former BYTE senior editor and author of The BYTE Guide to CD-ROM *(second edition, Osborne/McGraw-Hill, 1995), writes extensively about the Internet. You can reach him at* **m_nadeau@conknet.com.**

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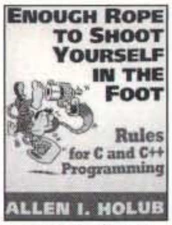
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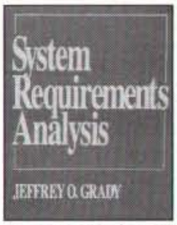

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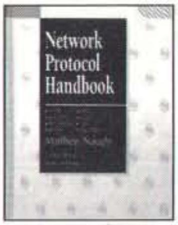

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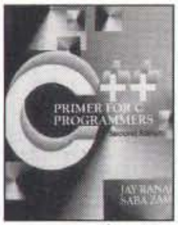

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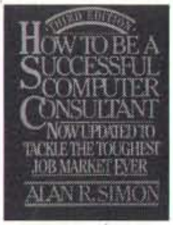
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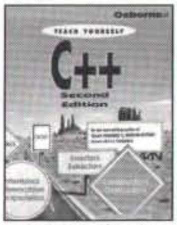

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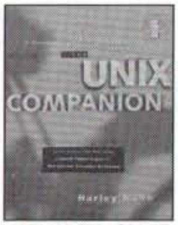

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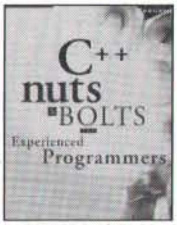

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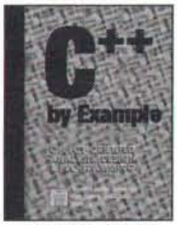

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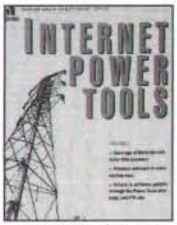

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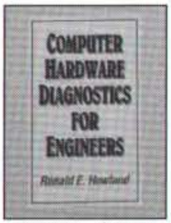

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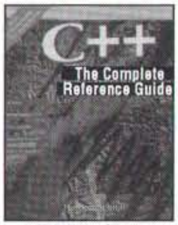

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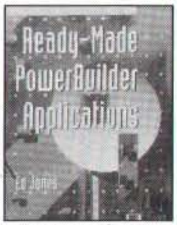

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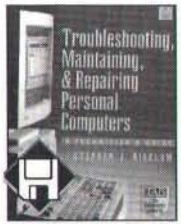
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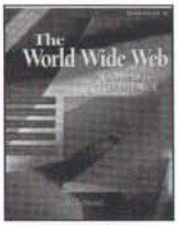

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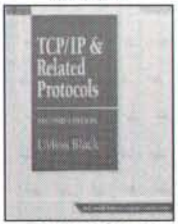

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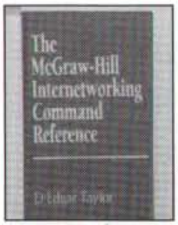

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CTI Matures

The "integration" component of CTI still isn't easy, but there's more help than ever for getting computers and telephones to work together efficiently.

Computers and telephones are two fundamentally different technologies, yet they have something in common: When they work together, we work more efficiently in applications that hinge on customer service and timely information. Unfortunately, integrating computers and telephones can seem about as easy as herding butterflies.

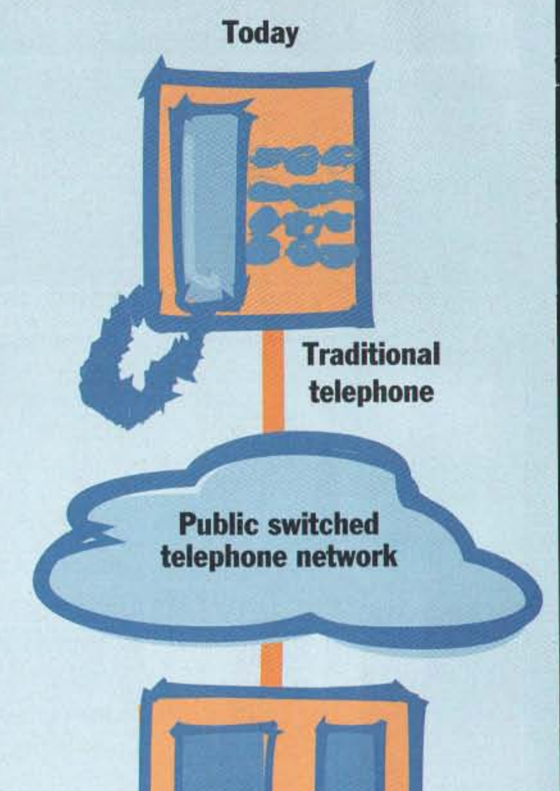
For this reason, some companies are only beginning to take advantage of computer telephony integration (CTI). Traditionally, call-center operators have benefited most from merging computers and telephones. However, CTI also makes possible fax-back systems, interactive voice-response implementations, and a number of specialized vertical applications.

Fortunately, the hardware, software, and integration techniques for CTI are maturing. For example, special-purpose add-in boards let you add PBX services inside a CTI server. The consolidation of call-switching and network-server functions makes the implementation and maintenance of CTI applications easier. In some cases, including large-scale call centers, you may need a more elaborate architecture with a stand-alone CTI server connected to a PBX and a database on a mainframe or distributed across a number of servers. More mature hardware and connection standards help these implementations, too. We asked a veteran CTI systems integrator to outline the basic components of a CTI implementation and explain how to make the right choices. His report, "CTI, Piece by Piece," begins on page 85.

Once you have the hardware in place, you'll need to develop end-user applications. Depending on the programming talents of your development team and the project's deadline, procedural languages, graphical applications-development environments, telephony components, and visual-programming tools should give you the power you need. "Tools for Telephony Apps," on page 91, describes where each of these alternatives shines or runs out of steam. We also asked two developers of CTI systems—one who chose to program in C++; the other who used visual-programming tools—to tell us how they made their development decisions. Their perspectives can help you focus your choices when it's time to develop your CTI application.

With new hardware and a wealth of development tools, CTI is easier, but still one of the trickiest integration tasks we face. At least the butterflies are now fluttering in the same direction.

–Alan Joch



CTI, Piece by Piece . . . 85

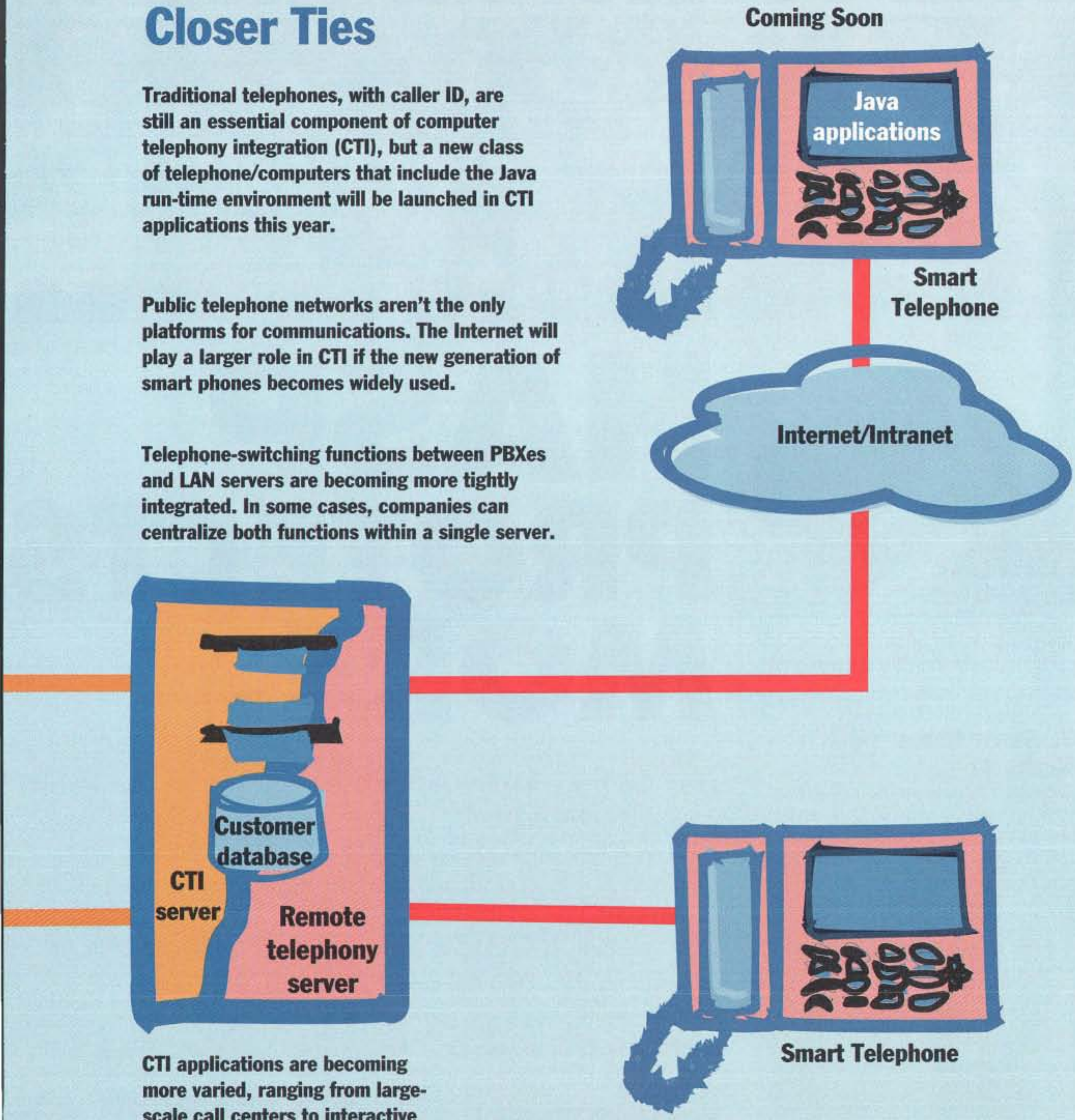
Stitching together a basic CTI system is still tricky. Here's help around the rough spots.

Closer Ties

Traditional telephones, with caller ID, are still an essential component of computer telephony integration (CTI), but a new class of telephone/computers that include the Java run-time environment will be launched in CTI applications this year.

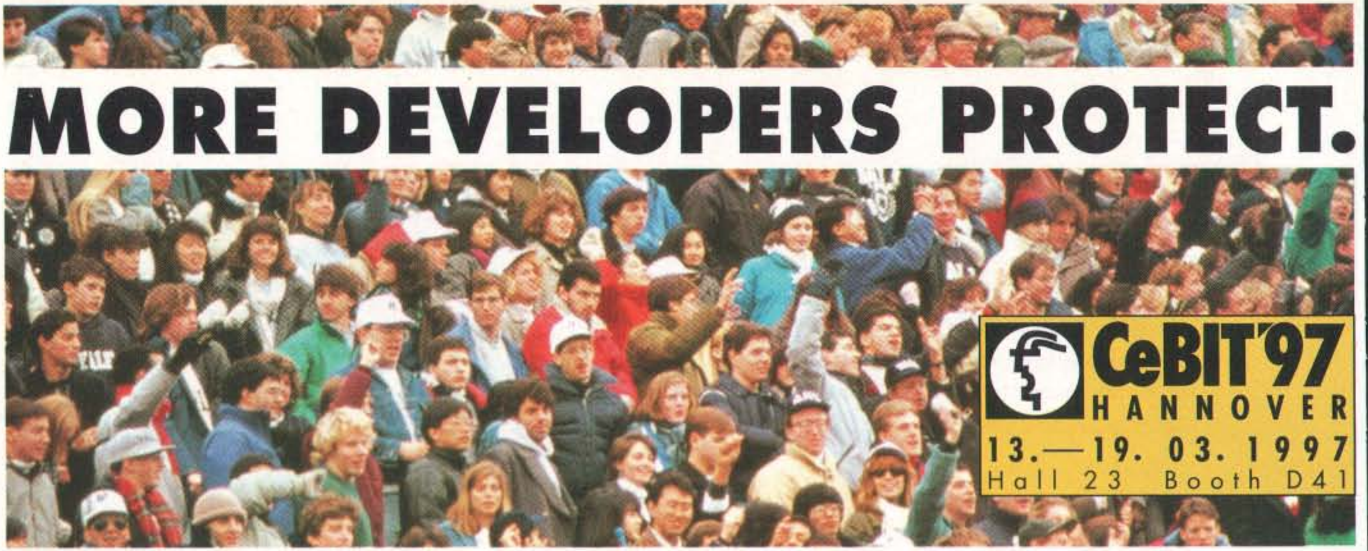
Public telephone networks aren't the only platforms for communications. The Internet will play a larger role in CTI if the new generation of smart phones becomes widely used.

Telephone-switching functions between PBXes and LAN servers are becoming more tightly integrated. In some cases, companies can centralize both functions within a single server.



CTI applications are becoming more varied, ranging from large-scale call centers to interactive voice-response implementations, fax-back services, and systems that use e-mail to send data to customers across the Internet. A wide range of development tools now support these efforts.

Tools for Telephony Apps . . . 91
There's a telephony development tool for almost any need or skill level.



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Stitching together a basic CTI system is still tricky. Here's help around the rough spots. ***By John Silling***

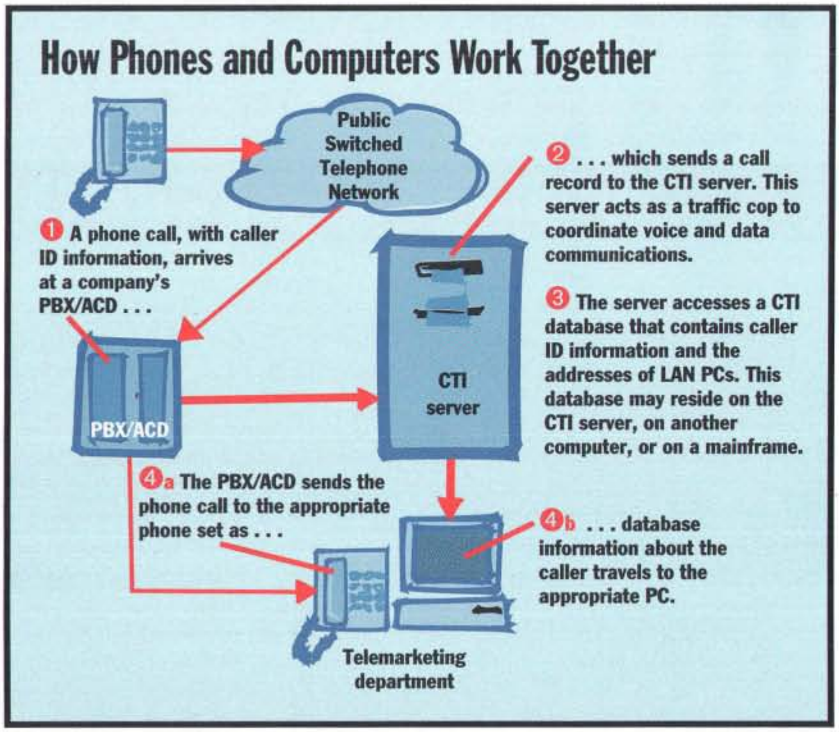
CTI, Piece by Piece

If you hear computer telephony integration (CTI) and killer application in the same sentence, you'll probably think of call centers. The ability to have an incoming phone call and an associated data file arrive almost simultaneously at someone's desk can improve customer service. And if you implement the system correctly, it also can reduce communications costs for your company.

However, call centers are only the tip of the CTI iceberg. The merging of computers and communications means you can fax follow-up information to a customer, schedule call-back times, send sales quotes via the Internet, and transfer calls—voice connection and data screen—to someone else in your company. CTI also underlies many ingenious vertical-market applications, like a health-care system where cardiac patients can hold a telephone to their chests and relay electrocardiogram data to distant telephony servers (see the text box "Visual Tools to the Rescue" on page 92).

Unfortunately, launching a CTI implementation still isn't easy. For example, most of the savings in communications costs derived from CTI can be found at the beginning of the call, during the call setup. However, the setup also is the point where many companies face their first CTI disappointment. A poorly designed implementation can actually increase the time it takes to answer and process incoming calls.

Complications arise because CTI still requires you to integrate fundamentally different types of computer and communications systems and technologies. Some integration help comes as APIs such as Telephony Server API (TSAPI), Telephony API (TAPI), and Java Telephony API (JTAPI) evolve. Also, automatic call distributor (ACD) and PBX vendors are opening up their system architectures to development tools that support industry standards. But to achieve the promise of reduced costs and to embrace advanced CTI capabilities, you need to understand the basic structure of a CTI implementation. Here's an overview.



How Phones and Computers Work Together

① A phone call, with caller ID information, arrives at a company's PBX/ACD . . .

② . . . which sends a call record to the CTI server. This server acts as a traffic cop to coordinate voice and data communications.

③ The server accesses a CTI database that contains caller ID information and the addresses of LAN PCs. This database may reside on the CTI server, on another computer, or on a mainframe.

④a The PBX/ACD sends the phone call to the appropriate phone set as . . .

④b . . . database information about the caller travels to the appropriate PC.

The CTI server is typically the linchpin that coordinates sending phone calls and data files to a target desktop.

The Basics

The first step in developing a basic CTI application is to add automatic number identification (ANI) service to incoming calls from your telephone company. ANI attaches caller ID with the voice call as it's being sent to your ACD or PBX. Phone companies typically charge you for the basic ANI service, then add an additional cost for each call. Note that the launch of a CTI project is a great time for you to review your relationship with your telephone company. At the least, make sure that yours bills each call in 15-second increments. Some customers are still being billed in 1-minute increments, which adds to the cost of the CTI application and other telephone activities.

When the call arrives at your company, your ACD or PBX strips off the ANI data, combines it with an internal phone extension, and sends the caller information to a CTI server. The CTI server compares the caller ID and phone extension with its database to find the right PC. Next, the CTI server generates a data record and sends it to a customer database that may reside within the CTI server, on another computer at the same location, or even on a mainframe host system in another geographical area. This data record requests that the customer information associated with the caller's number goes to a specific PC in the company—a telemarketing representative's, for example.

CTI servers—the traffic cops that direct voice and data to the right desktops—traditionally have been Unix boxes because of that platform's scalability and reliability. However, a new generation of Windows NT servers is gaining ground thanks to economical hardware costs and steady increases in the number of CTI applications that are being developed or ported to that platform. The next version of Microsoft's TAPI may provide better coordination between Windows NT and TAPI clients (see the text box "Building Bridges with TAPI and TSAPI" below).

You can team a CTI server with an ACD or PBX. In this way, you preserve your investment in existing telecommunications hardware, while adding the CTI capabilities you need. Alternatively, you can install multifunction servers in place of PBXes, thanks to chips from companies such as Dialogic and Mitel that can perform ACD/PBX-like switching tasks—sending incoming calls to an interactive voice-response (IVR) board or to a person's desktop, for example. You will need to install the proper telephony-interface cards to connect the CTI server to the phone network and to the internal phone system. The CTI server's plug-in boards handle such chores as IVR, voice mail, and fax on demand. Board vendors also are merging switching functions and telephony capabilities, such as IVR, onto single boards, thereby reducing the number of add-in boards and integration woes that CTI engineers need to contend with.

Another alternative is to use an ACD in lieu of a CTI server. Aspect Telecommunications, for example, can support CTI functionality directly in its ACD. The ACD acts like a transaction link server, where the ACD system itself takes on the role of the CTI server and provides routing information to a host system. This offers a

Building Bridges with TAPI and TSAPI

Your computer network and your phone network were not designed to work together. You can link the two systems at the application level, but first you need a common interface with which to build the applications. The two most significant of these interfaces are Telephony API (TAPI) and Telephony Server API (TSAPI). Both perform essentially the same function—they enable the construction of PC-based telephony applications that operate independently of the telephone network. Both are independent of the method of connection—direct serial link, add-in board, voice server, or switch-to-host link—between computer and phone system. (See the table for a comparison of features.)

They attain that independence by abstracting the hardware layer, thus sidestepping the need to write code specific to each proprietary switch (and there are many) while taking advantage of each system's unique capabilities. This pleases developers, but it also allows customers to keep their existing equipment. And both provide a means for extending the specification. Beyond these points, however, each takes a different approach.

TAPI

Microsoft and Intel were the primary developers of the originally client-based TAPI. TAPI 2.0, however, is built into both the Windows NT Server 4.0 and the Windows NT Workstation 4.0, which allows the OS to function as either a telephony client or server. (Windows 95 currently has built-in support for TAPI 1.4 applications, which are compatible with TAPI 2.0.)

In practice, TAPI 2.0 is focused on the desktop—a PC and a phone. That is, TAPI assumes the desktop to be one end point of each call. It preserves the ability to do third-party call control (calling from one desktop on behalf of another). The specification allows for several telephony applications to run simultaneously—over either a single or multiple phone lines—on a client or server PC. It provides a means to distinguish different media streams (data, voice, fax) and route calls to the appropriate application or device. Incoming faxes, for example, go to the fax application or machine.

TAPI is part of the Windows Open Services Architecture (WOSA). Like other WOSA services, such as those for printing or display, TAPI has two interfaces. The first is the API for developers writing the software. The second is the service provider interface, which provides a means of connection to a specific device—in TAPI's case, the telephone network. With TAPI 2.0, you can build applications for Public Switched Telephone Network (PSTN), ISDN, PBX, and IP networks. Want your applications to reach out over the Internet? TAPI can handle that, too. It essentially sees the Internet as just another service provider. Other TAPI features include support for Unicode, ActiveX controls, and Intel's universal serial bus (USB), a 12-Mbps port that can connect up to 127 devices to a single PC.

Microsoft has announced several planned enhancements for TAPI 2.0. They include a remote-service provider, intended to speed development of client/server telephony applications; remote administrative tools to aid with client/server configuration issues and reports; and Windows Telephony Service extensions for client access. (The company expects these features to appear in the next beta version of Memphis. At about the same time, Windows 95 will gain TAPI 2.0 support.) TAPI is closed:

TAPI vs. TSAPI

	TAPI 2.0	TSAPI
Server- or client-based	Both	Server
Required server	Windows NT	NetWare
Supported OSes	Windows NT, Windows 95 [1]	Windows (all), Unix, Mac, OS/2
32-bit support	✓	✓
16-bit support	✓ [2]	✓
Call-center support	✓	✓
High-speed bus support	USB	N/A [3]
Third-party call support	✓	✓
Media stream routing	✓	
Connection types supported	ISDN, PBX, PSTN, IP	PBX, Centrex
Extensible	✓	✓

[1] Release to coincide with next beta release of Memphis.

[2] Applications must be based on Win 16 and be fully TAPI 1.3–compliant.

[3] Because TSAPI uses only the server model, bus support on the desktop is irrelevant.

✓ = yes

cost-effective way to generate a basic screen-pop CTI application.

However, a transaction-link server works only if the CTI application does not need a front end to the host system database. A CTI server can program front-end information to rectify shortcomings in a host system's database. This front-end service is a benefit if a customer's calling-from number is missing from the host system's database or in a cellular operation where the customer may be calling from a number of different phones. A front-end CTI server database can correct these shortcomings in the host system without your having to rewrite the host system's application.

In addition, if your CTI application needs to access a number of host systems to supply the first data screen, preloading the CTI server database will provide a single GUI even if your CTI application connects to a variety of hosts, such as a 3270, 5250, or telnet-supporting system.

Anyway you look at it, front-end loading the CTI server is a much better alternative than either rewriting the host system's database or trying to synchronize several host systems. Additionally, you can modify the front-end database in the CTI server with simple additions, modifications, and deletions as changes to the host system take effect.

What's Inside

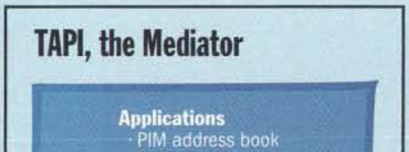
The processing power you need for your CTI server depends on the size of your application. Some companies can fulfill their server needs with inexpensive 486-based systems (see "When C++ Is Right" on page 93). Whatever processor you choose, take advantage of today's

Microsoft controls it, which makes developers of telephony products nervous. Microsoft claims that since many other companies (more than 40) have contributed to the TAPI specification, it is effectively industry-defined and, therefore, open. However, where independent organizations define and approve other industry standards, Microsoft remains the final arbiter of what TAPI is.

TSAPI

Server-based TSAPI, developed by Novell and AT&T, is designed to integrate PBX or Centrex phone systems with Netware networks. The only physical link in the system is between the NetWare file server and the phone network. Applications built with TSAPI have a logical link between the PC and the desktop phone. You can control calls through the applications from either end of the connection or hand off that control to a third party. A server telephony model also eliminates the need for additional hardware to connect desktop PC to phone. This can save a lot of money in a large organization, but there is a trade-off. Because there's no physical connection between the PC and the phone, TSAPI applications cannot identify different media streams as TAPI can. Thus, with TSAPI, you cannot automatically route a fax to a fax application, for example.

The TSAPI specification has wide industry support, especially among PBX and Centrex vendors, virtually all of which offer NetWare drivers for their systems. Just as important, TSAPI supports all the major OSes, including Windows (all versions), the Mac OS, OS/2, and Unix. This, obviously, appeals to companies building cross-platform telephony applications.


TAPI, the Mediator

TAPI provides hooks into applications and communications systems.

Unlike Microsoft with TAPI, Novell and AT&T have handed over the TSAPI specification to the European Computer Manufacturers Association (ECMA), which developed the Computer-Supported Telecommunication Applications (CSTA) standard on which TSAPI is based. ECMA is currently working on Phase II of the CSTA specification, due to roll out sometime this spring. Slated improvements to TSAPI include access to voice services, so that you can perform all functions of your phone system (e.g., play or record a message) from within a TSAPI application. Phase II will also allow TSAPI applications to transfer data with calls, so that, for example, help-desk personnel can take information from a customer and transfer that data and customer to another person. In addition, Novell is working with Sun Microsystems to support its initiative for JTAPI, the API for building Java-based telephony applications.

Pros and Cons

TAPI is by far the more popular interface for telephony applications. For many companies, its tight integration with Windows is a plus, but more important is the fact that both client and server components come bundled with the OS. Novell charges $26,995 for a 250-seat TSAPI implementation (including a NetWare run-time module). For businesses with NT-based networks, TAPI is a no-brainer for a server-based telephony model. It also makes sense for small companies that tend to use a direct connection between the PC and phone.

Thanks to its multiplatform support, TSAPI is better suited for more diverse environments running on a NetWare backbone. And despite its cost, TSAPI actually is cheaper to implement in non-Windows NT environments. The alternative there is client-based TAPI 1.3, which requires an add-in board on each PC.

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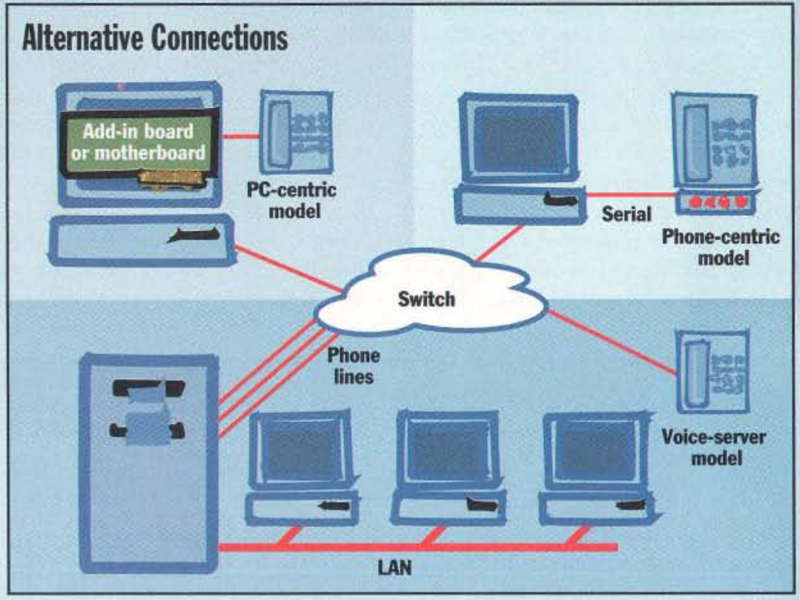
Link PCs to Phone Networks

You can connect a PC to a phone system in one of four basic ways. The phone-centric model requires an external adapter or telephone that is connected through the PC's serial port. It is easy to configure, but could be limited in terms of how much information and control it supports from the PC. In the PC-centric model, the phone line terminates on a card in the PC or on the motherboard itself. This model maximizes the information and control delivered to the PC.

The switch-to-host model establishes a logical connection via the LAN between the PC and phone (see the figure on page 85).

The voice-server model uses ordinary lines between the server and the PBX or key system. This model allows the routing of information to the server via the LAN and then transmission over the phone network. **–M.N.**



Alternative Connections

low costs for RAM and disk-storage capacity, especially if the CTI server will act as a front end to a host system. The rule of thumb is to install the maximum amount of RAM the system can handle and buy at least a 5-GB hard drive. The last thing you want is to take down a CTI server to upgrade RAM and storage capacity when each is so cheap to install at the beginning. For reliability, many CTI applications require a RAID subsystem or a redundant CTI server that can automatically step in if the primary server fails.

Several methods are available to connect your CTI server to your ACD or PBX. Some ACD and PBX vendors provide a direct connection between ACD or PBX and the CTI server, but this is typically with proprietary systems. Others prefer that you connect the ACD or PBX to the CTI server using a LAN and TCP/IP. In either case the ACD or PBX vendor will supply the interface card to its product. TCP/IP is becoming the de facto standard for connecting PCs to CTI servers and CTI servers to the ACD or PBX. X.25 was prevalent when terminals outnumberd PCs on the desktop. Unfortunately, serial interfaces between PCs and the CTI server still exist, but no one should consider doing this today.

CTI projects often force companies to establish interface and connectivity standards for the way CTI components communicate. This is an area where the information systems and telecommunications departments may clash. If your company is like most, you're using the communications stacks provided by the network OS (NOS). However, the connectivity interface of the ACD/PBX will be limited and may force the CTI application to use an interface protocol that is not supported by the current information systems' network plan.

A CTI launch should be a catalyst for setting a companywide standard if one does not exist. If you already have not done so, this will be the most costly part of the CTI application and may require you to purchase new hardware and software. In addition, you should design, configure, and deploy the data transport protocol (such as TCP/IP) in conjunction with your physical cabling plant. This is no simple task, so plan accordingly. Mistakes and lack of communication and understanding between the information systems and communications groups, as

Does CTI Pay?

How do you determine if the computer telephony integration (CTI) project you're considering is cost-effective? The first step is to determine your current call setup time. Here's how we did that calculation from one recent customer.

First we timed how long it took the customer's operators to recite a canned greeting. Typically, that greeting took 7 to 10 seconds to say–plenty of time for even a slow network to query a host system and return the proper screen. We then tested the host system's response time and determined that the first data screen to come up during a peak incoming calling hour was an average of four seconds. Not bad, considering this was a call center of about 400 operators, and the host systems were in another state.

Using this example, it would take 24 seconds to set up the call: 8 seconds to greet the customer, 12 seconds to gather the customer's home phone number, and 4 seconds to query the host system for the first data screen. This 24 seconds was the actual setup time of the incoming call and the time that a CTI application must reduce to achieve any return on investment.

Using this information, we estimated that by capturing the customer's automatic number identification (ANI), and prompting the host system for information during the time the operator is greeting the customer, we could reduce the setup time of each call by 16 seconds. We calculated that our customer could take approximately 164 more calls per day before adding more staff (based on the fact that the average call was 7 minutes long and each operator took an average of 55 calls a day).

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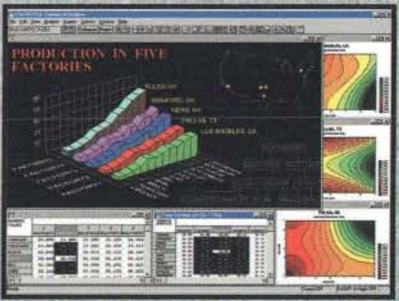
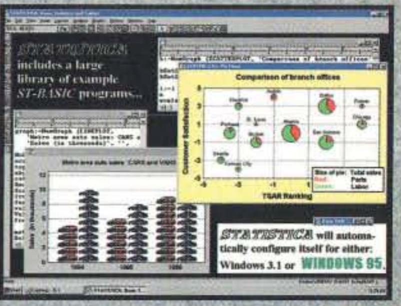
STATISTICA supports multitasking.

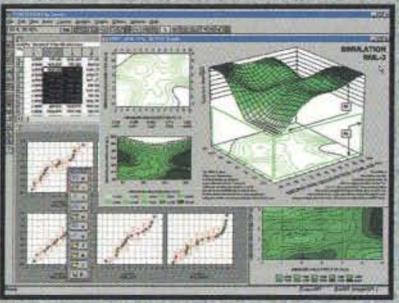
For example, now I am typing this text in MS Word, and in the background, STATISTICA is recalculating a large model (see the red progress bar).

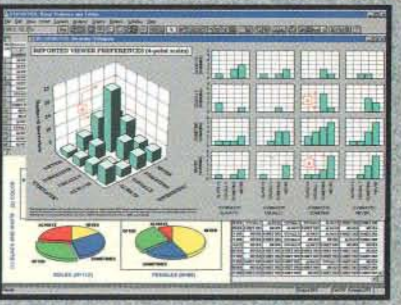


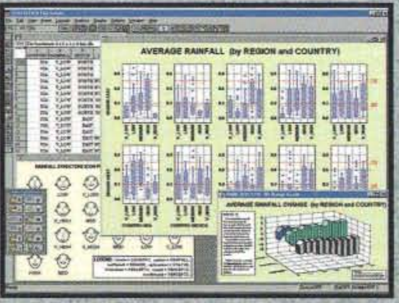


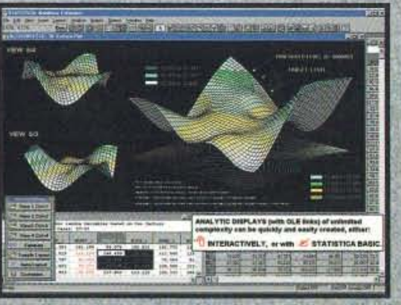
STATISTICA includes a large library of example *ST-BASIC* programs...

STATISTICA will automatically configure itself for either: Windows 3.1 or WINDOWS 95.

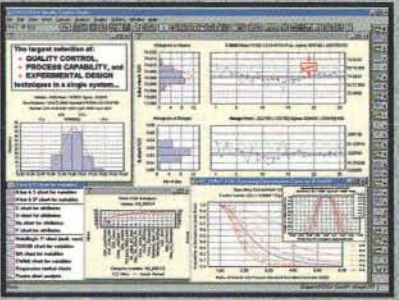








ANALYTIC DISPLAYS (with OLE links) of unlimited complexity can be quickly and easily created, either: INTERACTIVELY, or with STATISTICA BASIC



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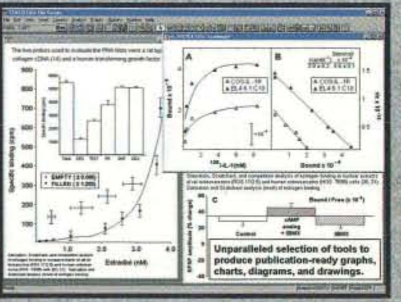
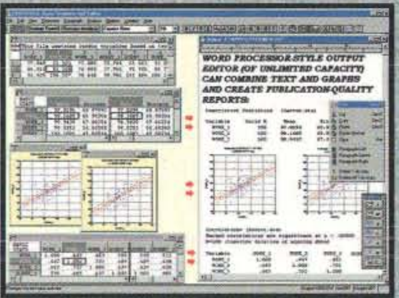
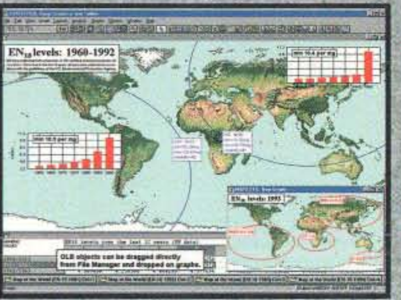


Unparalleled selection of tools to produce publication-ready graphs, charts, diagrams, and drawings.



WORD PROCESSOR-STYLE OUTPUT EDITOR (OF UNLIMITED CAPACITY) CAN COMBINE TEXT AND GRAPHS AND CREATE PUBLICATION-QUALITY REPORTS:



OLE objects can be dragged directly from File Manager and dropped on graphs.

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well as poor project management, can lead to improper specification of technologies, which could haunt your CTI application for years.

Accuracy Counts

The main job of the CTI server is to manage the routing table information—the ACD or PBX phone extensions and the network LAN and WAN addresses of each PC. It is important that you program a detailed and precise routing table into the CTI database. You need only check and double-check the work of the person who entered the addressing data. Nevertheless, accurate routing-table input can be one of the most time-consuming parts of the CTI development and deployment cycle. Errors in routing tables can lead to disaster because a single mistake can take down two CTI positions at a time as a phone call and a data screen travel their separate ways through your company.

Once all the preceding items have been addressed, your next critical decision will be what CTI software development tools you'll use to create custom applications. If you have unlimited information systems resources and a talented coding team, you may choose Visual Basic, Delphi, PowerBuilder, C, or C++. Or you may choose canned development GUI tools (see "Tools for Telephony Apps" on page 91).

Before you start any GUI development effort, you should sit down with your operators to get a detailed understanding of just how incoming calls flow and how the operators interface with customers. This may sound basic, but we've been involved in a number of CTI fixes where thousands of dollars were spent on the best equipment only to have the CTI project fail because no one asked the operators how the calls flowed once they answered the phone.

Plan for the Future

Once you've established the fundamental building blocks of a CTI application, customer-service improvements and cost savings can be just one more application away. For example, we recently expanded a basic CTI application into a system called computer and interactive voice response (CIVR). CIVR prompts the customer for specific information prior to the operator receiving the call. This can result in cost savings greater than the traditional CTI application because some callers may not need to speak to a person to get the information they want. If a caller needs a live operator, a simple key press will correctly route the call and ID information.

The best CTI project targets present needs while building for the future. Don't fall into the short-vision trap. ■

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John Silling is a consultant for call-center development at Logica, a systems integrator. You can reach him c/o **editors@bix.com.**

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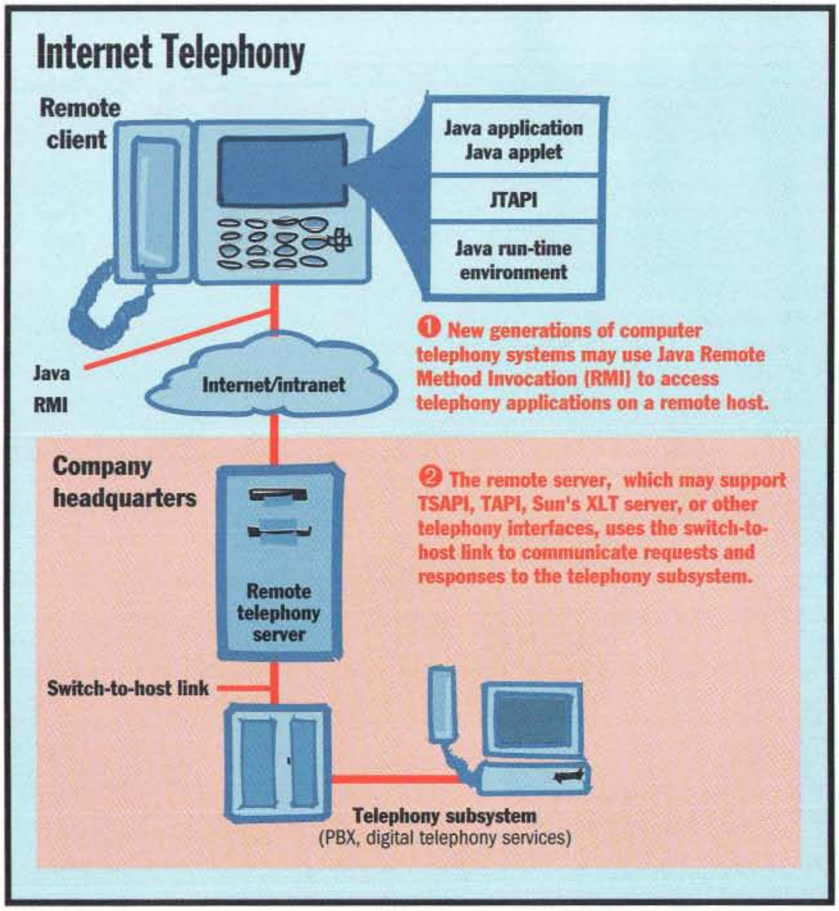
State of the Art

There's a telephony development tool for almost any need or skill level. By Michael Nadeau

Tools for Telephony Apps


Internet Telephony
Remote client
Java application
Java applet
JTAPI
Java run-time environment
❶ New generations of computer telephony systems may use Java Remote Method Invocation (RMI) to access telephony applications on a remote host.
Java RMI
Internet/intranet
Company headquarters
❷ The remote server, which may support TSAPI, TAPI, Sun's XLT server, or other telephony interfaces, uses the switch-to-host link to communicate requests and responses to the telephony subsystem.
Remote telephony server
Switch-to-host link
Telephony subsystem
(PBX, digital telephony services)

Component-based CTI, with telephony APIs like Sun's JTAPI, is easier than writing C code but more robust than drag-and-drop tools.

The days of creating telephony applications using the Hayes AT command set are long gone. Today, you have just as many choices of telephony development tools as for any other type of application programming. At the lowest levels, you can use a procedural language such as C to write code that speaks directly to the telephony hardware. Or you can work in a graphical development environment and avoid actual coding altogether. Component software and visual programming tools let you build telephony applications by linking ready-made modules.

Choosing the right tool from this mix of approaches, however, isn't always easy. In this article we'll discuss how the major types of programming tools for CTI compare. We'll also look at two companies that chose different approaches—low-level procedural programming versus visual toolkits—for CTI development.

Block by Block

Inevitably, your choice of development tool will represent a trade-off between power and ease of use. Writing your software in C, for example, puts you in full control of all the telephony hardware's capabilities but requires a high level of skill (see "When C++ Is Right" on page 93). C is generally the language of choice for OEMs developing applications for resale. At the other end of the spectrum, visual programming tools offer drag-and-drop application construction but little hardware control (see "Visual Tools to the Rescue" on page 92).

Fortunately, component software offers a middle ground for developing telephony applications. Several companies, such as Pronexus, Artisoft, and Technically Speaking, sell telephony-specific ActiveX components. Microsoft has tightly integrated ActiveX controls with its Telephony API (TAPI) spec. Component software presents a graphical development environment and allows programmers to avoid having to code much of an application's internal plumbing. With software components, you can create larger applications by combining smaller, more specialized programs. This leaves programmers having to code only those functions unique to their programs, using the component software's native language or a variety of other tools. The benefit of using components can be rapid development with a high level of customization.

Component building blocks are becoming widely available. Microsoft boasts that over 1000 ActiveX controls are now available. The company recently turned over control of the ActiveX spec to The Open Group (http://www.opengroup.org), an industry standards-setting consortium. It, in turn, has set up the ActiveX Working Group (http://www.activex.org/), which is entrusted to develop the ActiveX standards. As an open standard, ActiveX should see broad industry support.

Java Telephony

ActiveX has competition on the horizon in the form of JTAPI, the Java Telephony API proposed by Sun Microsystems, which developed the spec with a handful of companies, including Intel, Lucent Technologies, Nortel (Northern Telecom), and Novell. It is essentially a set of reusable telephone call-control objects. Java-based telephony applications will run on any computer with a Java virtual machine and a JTAPI telephony subsystem. Because they are based on Java, JTAPI objects are independent of any operating system and hardware platform and are therefore portable from one platform to another (see the figure "Internet Telephony" on page 91).

JTAPI defines a set of class libraries consisting of a core group of telephony capabilities and a set of extensions that developers can use as needed for individual applications. For example, one set of extensions handles tasks such as call routing and setting up conferences among groups of callers.

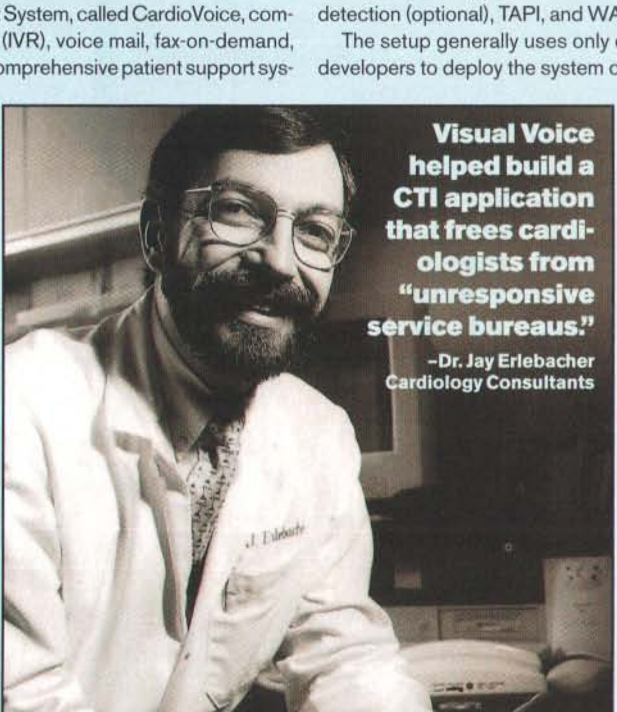
One of the more promising applications of JTAPI will be a new generation of hybrid phones that combine traditional telephone service with a Web-capable device you can use for browsing and e-mail. Sun says it is developing, along with Nortel, an Internet telecommunications device that uses JTAPI to link to other phones, desktop computers, and network computers via the Internet. JTAPI works with other telephony APIs, such as TAPI and Novell's

Visual Tools to the Rescue

Some CTI systems only seem like lifesavers. For thousands of cardiac patients, CTI actually is an essential tool for keeping them alive. The Paceart Associates transtelephonic electrocardiogram (ECG) and arrhythmia monitoring systems let patients send heart-monitor information to their doctors over the telephone by holding the receiver to their chests.

Paceart's add-on to the Paceart System, called CardioVoice, combines interactive voice response (IVR), voice mail, fax-on-demand, and outbound messaging into a comprehensive patient support system. CardioVoice was written in Microsoft Visual Basic and uses Artisoft's (formerly Stylus's) Visual Voice Pro telephony toolkit and Microsoft Access database. Visual Voice provides a high-level interface to standard telephony and fax features. The toolkit contains custom controls (VBX, OLE Control, and DLL versions) and a graphical Voice Workbench. Visual Voice supports a variety of telephony equipment, including TAPI-compliant hardware, multiline voice-response boards, and single-line fax/modem/voice boards. The developers used assembly language to code the portion of the system that does real-time collection of the ECG data.

"Visual Voice gave us a simple yet powerful toolkit to leverage our expertise in Access Basic and develop quickly," according to Dr. Michael Bergelson, CardioVoice's chief designer.


Visual Voice helped build a CTI application that frees cardiologists from "unresponsive service bureaus."

–Dr. Jay Erlebacher Cardiology Consultants

CardioVoice has two major components: proprietary CardioVoice Phone clients and an unattended "receiving station" telephony server, which is normally located in the physician's office. The proprietary CardioVoice phones (desktop, portable, or cellular) are actually pacemaker and ECG transmitters. By attaching special electrodes to the phone handset and either holding them with both hands or pressing them to their bare chest, patients can easily transmit frequency-modulated heartbeat data to a receiving station. The receiving station converts the analog data to digital form and transmits the patient's name, phone number, and heart rate to the attending physician's alphanumeric pager. The physician can then dial into the receiving station and have the patient's ECG plot faxed back to them.

The basic Paceart system runs on a Windows PC. Receiving stations are typically a Pentium-class PC with 16 MB of RAM running Windows 95. The Dialogic Proline/2V telephony card that's used in the system can handle two analog lines simultaneously. The 16-bit Dialogic cards support such features as caller ID, global dial-pulse detection (optional), TAPI, and WAV audio.

The setup generally uses only one or two lines. This allows the developers to deploy the system on an inexpensive Windows 3.11 or Windows 95 PC. For reliability, the designers use redundant phone lines and often connect two telephony servers that work in tandem to minimize downtime if the PC or telephony card fails.

Currently, more than 450 pacemaker and arrhythmia centers are using the Paceart system to monitor about 75,000 patients every day. The system's primary users are people who wear pacemakers and others who are considered at-risk and require intermittent cardiac monitoring. Each patient has a unique voice-mail box that enables patients and physicians to communicate efficiently. CardioVoice can also make scheduled calls to subsets of the patient database to confirm appointments, send medication reminders, and relay test results.

Dr. Jay Erlebacher of Cardiology Consultants is an enthusiastic user of CardioVoice primarily because it is convenient for physicians and patients. "In the past we had to rely on a service bureau to distribute the loop recorders to the patients, attend the phone uploads of the data, and deliver the results to us. This whole process would often take several days. With CardioVoice and our own Paceart loop monitors we can be monitoring a patient and receiving results in a day or less without being at the mercy of an unresponsive and expensive service bureau."

Joe Tartaglia *is the vice president of High Caliber Systems (New York City), a developer of custom computer telephony systems. You can reach him at JoeT@HighCaliber.com.*

PHOTOGRAPHS: KELLIE WALSH © 1997

Telephony Services API (TSAPI), to invoke telephony capabilities.

Drag-and-Drop Apps

Although telephony components are gaining ground, many companies also opt for an application toolkit when developing internal telephony programs. These products are sometimes called application generators, though that term is more accurately associated with their text- or forms-based predecessors. Application toolkits are highly graphical environments that let you build software by linking telephony functions. These toolkits, which often use a flowchart metaphor, let you select common functions—such as "pick up receiver" or "send fax"—that are represented as icons or menu choices. You drag and drop these choices into place. No programming skill is required, but you do need to understand syntax and logic—how all the pieces of your application interact.

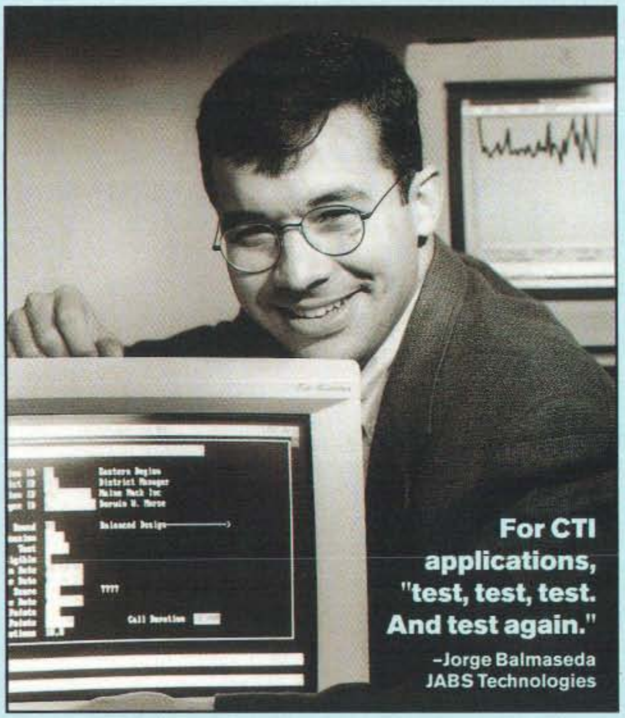
It is possible to create complete applications in this manner. But what happens when some feature or customization you need can't be done with a toolkit? You can extend the toolkit's capabilities in a number of ways, depending on the specific product. In most cases, you can incorporate C or Visual Basic routines into the application that the toolkit creates. In

When C++ Is Right

Dr. Quiz makes house calls. Or more accurately, office visits to Pfizer, Time Inc., Coach Leatherware, and other large companies. The good doctor is actually a custom-built interactive voice response (IVR) system used by Professional Motivation Technologies (PMT), which provides training services. Graduates of the company's program call a special number to take a quiz that reinforces and measures the caller's understanding of training materials. The responses help managers measure the effectiveness of their instruction efforts and improve their return on their training investment.

Few Tools

JABS Technologies, the system's designer and developer, built Dr. Quiz from the ground up without using any of the various CTI toolkits or application generators on the market. "When work on Dr. Quiz began over three years ago, there weren't many tools available for the Windows NT platform," says Jorge Balmaseda, JABS president. So JABS and codeveloper High Caliber Systems, a New York City-based systems integrator, wrote the software using Microsoft Visual C++ 4.2 and Dialogic's software development kit. Microsoft SQL Server 6.5 stores responses and other data.



For CTI applications, "test, test, test. And test again."

–Jorge Balmaseda
JABS Technologies

Multithreaded

Balmaseda says the development environment gave him complete control over system availability, scalability, and extensibility. Windows NT provides a stable platform with sophisticated event-logging and performance monitoring. It allowed JABS to build a multithreaded application as a service that runs in the background whenever the PC is running. (Dr. Quiz runs on a 486/66 PC with 32 MB of RAM and NT Workstation version 4. A Dialogic 121/B telephony card can handle up to 12 analog lines simultaneously, although the software was designed to handle at least 10 times that number, according to Balmaseda.)

For high availability, call processing can be manually switched over (locally or remotely) to a standby PC if the primary PC happens to go down. The manual switch-over is accomplished using NT's Service API. A remote watchdog PC automatically monitors the main system through NT's remote procedure calls. This standby PC can take over operations if the main system goes down. Line counts can be increased by increasing telephony card densities in the PC or by adding more PCs.

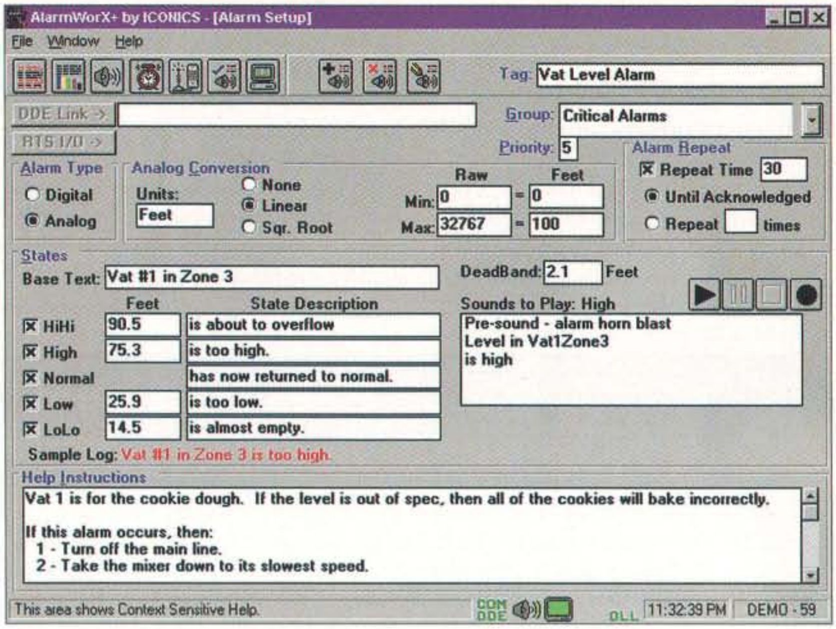
One of the biggest problems the developers faced when building the system was the lack of multithreading in the Microsoft Foundation Classes (MFC) Open Database Connectivity (ODBC) classes. The programmers ended up dropping MFC in favor of directly using the ODBC API for all database access.

Plugging Leaks

Memory leaks that occurred only after hundreds of calls had been made also stalled the development process. What are Balmaseda's primary words of wisdom to those people starting to develop their own CTI applications? "Test, test, test. And then test again."

In the end, however, the interactive voice-response system has saved the company hundreds of worker hours. When PMT started out four years ago, students received and returned quizzes by fax, but as business grew, faxing thousands of tests each month and grading them by hand became a time- and resource-consuming nightmare. Quizzes now are graded on-the-fly, scores are automatically entered in the database, and PMT can feed analytical reports back to clients in a matter of hours instead of weeks.

– Joe Tartaglia



Tag: Vat Level Alarm

Group: Critical Alarms

Priority: 5

Alarm Type: ○ Digital ● Analog

Analog Conversion: Units: Feet ○ None ● Linear ○ Sqr. Root

	Raw		Feet
Min:	0	=	0
Max:	32767	=	100

Alarm Repeat: ☒ Repeat Time 30 ● Until Acknowledged ○ Repeat ☐ times

Base Text: Vat #1 in Zone 3

DeadBand: 2.1 Feet

	Feet	State Description
☒ HiHi	90.5	is about to overflow
☒ High	75.3	is too high.
☒ Normal		has now returned to normal.
☒ Low	25.9	is too low.
☒ LoLo	14.5	is almost empty.

Sounds to Play: High

Pre-sound - alarm horn blast
Level in Vat1Zone3
is high

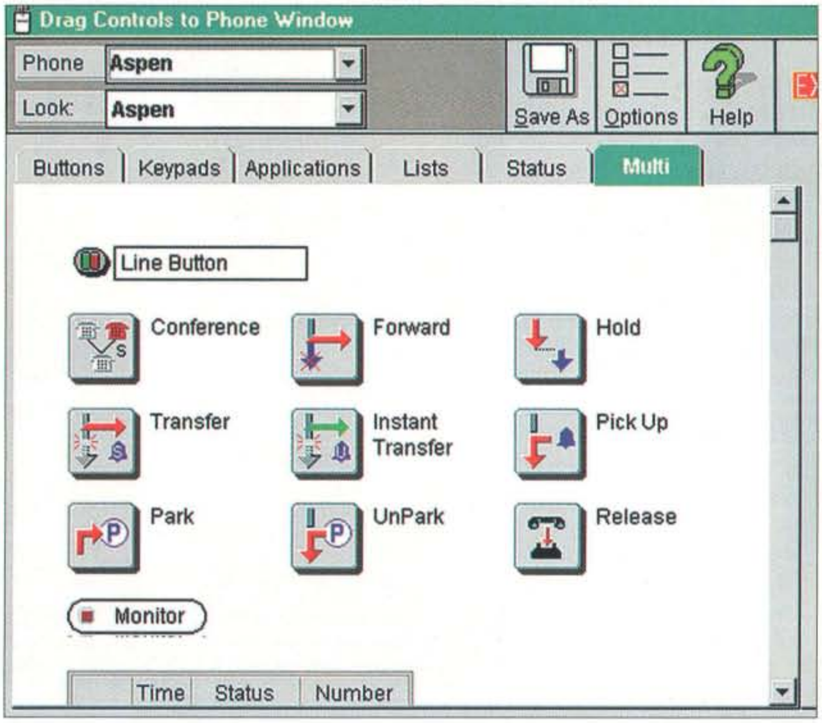
Sample Log: Vat #1 in Zone 3 is too high.

Vat 1 is for the cookie dough. If the level is out of spec, then all of the cookies will bake incorrectly.

If this alarm occurs, then:
1 - Turn off the main line.
2 - Take the mixer down to its slowest speed.

This area shows Context Sensitive Help. 11:32:39 PM DEMO - 59

AlarmWorX+ lets you build an event-monitoring and notification application by filling in templates.



Phone: Aspen

Look: Aspen

With PhoneKits, you can build telephony applications by dragging and dropping icons that represent different phone functions.

other cases, customization requires you to use the toolkit's own proprietary scripting language.

There are two basic kinds of toolkits. The classic application toolkit takes a proprietary approach; to change the code the toolkit produces, you either must know the proprietary language or go back to the drawing board and reconstruct the program. Having a proprietary language can be an advantage because it is designed strictly for telephony applications. Some are similar to more popular languages such as C. Examples of proprietary-language toolkits include MediaSoft Telecom's IVS Builder Pro and Apex Voice Communications's OmniVox. IVS Builder Pro is particularly interesting in that it allows you to generate Unix applications using the Windows GUI environment. Anyone who has built applications using development software such as PowerBuilder or Gupta will likely be comfortable using this type of toolkit.

The other category of toolkit is often referred to as visual telephony. These products are usually based on a version of Microsoft's Visual Basic (Pronexus's VB Voice 32 uses Visual C++) enhanced with telephony-specific extensions. You can modify applications created with visual telephony toolkits by modifying the Visual Basic code it outputs or by using prepackaged routines, or reusable objects, available from a number of vendors—really just another form of component software. Visual telephony has obvious appeal to any developer already familiar with Visual Basic. Artisoft's Visual Voice (see screen on page 96) and Voysys's VoysAccess are examples of visual telephony environments.

Easier Still

A new breed of telephony application builder is emerging. These products are actually closer to shrink-wrapped applications than to more traditional development environments. You install them much as you would any common Windows program. Pull-down menus and dialog boxes let you customize the application. Examples include Iconics's Alarm WorX+ and Algo Communications's PhoneKits (see screens at right).

These products package basic telephony functions into a single application. You could use such a package as is, customize the look and feel, or write your own controls and functions. Alarm WorX+ is a Windows-based multimedia alarm-management system that monitors events and notifies, through a Dialogic telephony board, the appropriate people by phone or fax. You modify the program by filling in templates, clicking on selection boxes, typing in data at prompts, or choosing items from a drop-down list. Early this year, Iconics expects to make available ActiveX controls that provide

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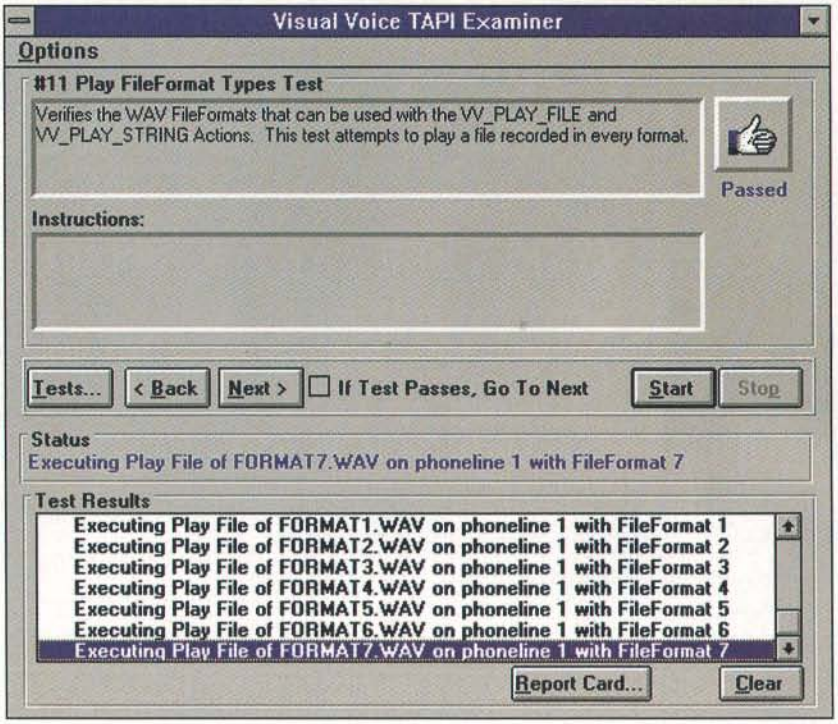
Circle 196 on Inquiry Card (RESELLERS: 197).

the individual functions of Alarm WorX+ in componentized form.

PhoneKits, also Windows-based, is intended primarily for OEMs or VARs. Compaq, for example, used it to create the telephony applications bundled with the Presario 7100 series PCs. The product is essentially a packaging of generic telephony features. PhoneKits is designed to help OEMs or VARs avoid having to reinvent the wheel when developing their applications; they can instead focus their efforts on value-added features and building a unique user interface. Developers must create those features using what Algo calls Phone Object Controls, which are standard DLLs. Last fall, Algo previewed another Windows telephony product called Workgroup Attendant. It lets you set up voice menus that allow callers to, for example, connect to the appropriate person to retrieve specific information. Workgroup Attendant lets you build the CTI application by simply dragging devices into an outline.



Verifies the WAV FileFormats that can be used with the VV_PLAY_FILE and VV_PLAY_STRING Actions. This test attempts to play a file recorded in every format.

```
Executing Play File of FORMAT7.WAV on phoneline 1 with FileFormat 7
```

```
Executing Play File of FORMAT1.WAV on phoneline 1 with FileFormat 1
Executing Play File of FORMAT2.WAV on phoneline 1 with FileFormat 2
Executing Play File of FORMAT3.WAV on phoneline 1 with FileFormat 3
Executing Play File of FORMAT4.WAV on phoneline 1 with FileFormat 4
Executing Play File of FORMAT5.WAV on phoneline 1 with FileFormat 5
Executing Play File of FORMAT6.WAV on phoneline 1 with FileFormat 6
Executing Play File of FORMAT7.WAV on phoneline 1 with FileFormat 7
```

The TAPI Examiner lets you analyze a hardware device to determine which Visual Voice features it supports.

Testing CTI Apps

Once you've built your CTI application, be prepared for a testing cycle that can be an order of magnitude more difficult than testing traditional desktop programs. Here are some things to keep in mind when testing CTI applications:

First, consider an outside service to help you evaluate a system beyond the unit-testing phase. For example, some, like Interactive Quality Services, will develop a test suite for you and then flood your application with thousands of calls. The company will then fax you detailed statistics on port availability, response time, failures, and other critical factors. Services like these are great for final integration and regression testing. This level of stress-testing will also help you find memory leaks that reveal themselves only after thousands of cycles.

Second, make sure your test environment matches your production environment. This goes for hardware (computer and telephony), operating systems, and application software.

Third, use testers with a variety of skill

Killer Apps, Today and Tomorrow

Electronic administrative assistants

A new class of products including Wildfire, from Wildfire Communications, manage all aspects of daily telephone communications. Using speech recognition, these programs help you quickly connect with key contacts and increase your overall availability for important communications. During a single call into the system, for example, Wildfire can screen, route, and announce incoming calls, "voice-dial" outgoing calls, schedule and remind you of action items, and create on-the-fly conference calls from any phone.

Unified messaging

Single desktop application combines all your messages–voice, fax, e-mail (private network and Internet)–into a common inbox. Users can respond to messages more efficiently.

Hybrid PCs/telephones

The telephone won't disappear, but CTI applications will begin to replace "dumb" handsets. These devices will give us Internet access and let us control inbound and outbound messages using GUIs instead of arcane key combinations. AT&T, InfGear, Nortel, Sun Microsystems, and others have announced Internet communications devices, which should ship in the first half of this year and sell for about $500.

Distributed call centers

Companies can save money by creating virtual call centers that route calls to idle agents all around the country as if they were in one place. The virtual centers will replace traditional centralized call centers with hundreds of telemarketing agents waiting to take incoming customer calls.

Merging voice and data networks

Five years from now, communicating via a Web browser and a URL will become more prevalent than making a phone call. However, if after browsing a Web site you need to contact a sales representative, you'd only click a button to speak–and see–someone. This will become possible only when high-bandwidth networks that blend voice, video, and data become common.

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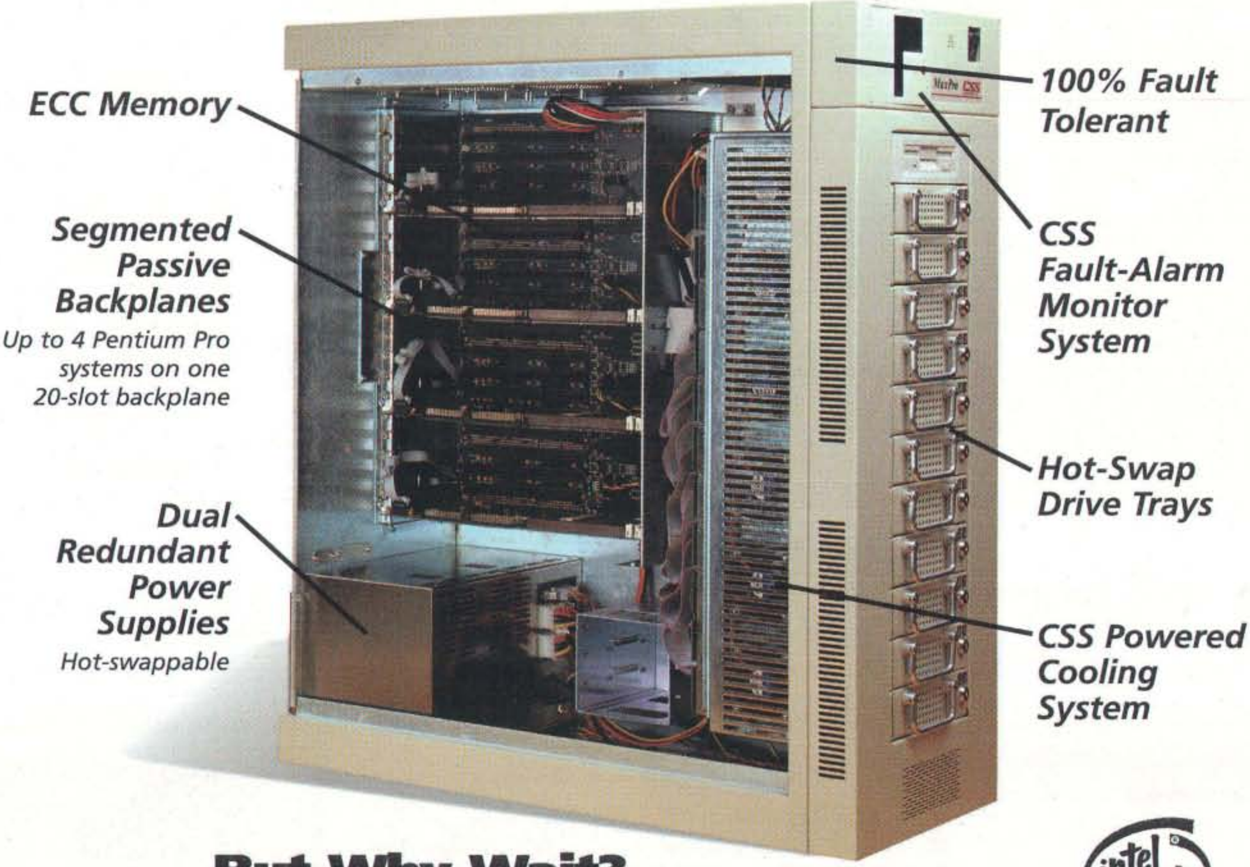
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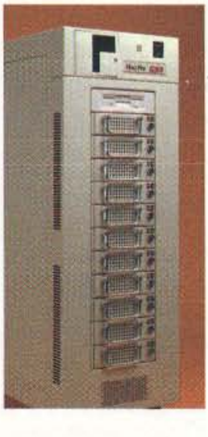

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Circle 137 on Inquiry Card (RESELLERS: 138) levels and a variety of phone and fax equipment. Novice users will alert you to confusing elements of the user interface and will make mistakes you never dreamed of. Together these mixed-skill groups may uncover problems that would otherwise probably go undetected in more formal tests.

Finally, watch out for those "extra services" on your phone lines. Call waiting, call answering, and even caller ID can cause problems with your CTI applications. Make sure the lines you are using are as vanilla as possible.

The good news is that no matter what kind of development environment you use, and no matter what degree of programming and testing muscle you can devote to application development, you'll likely find the right tool for generating telephony programs. **B**

Michael Nadeau is a writer and a former BYTE editor who covers communications technology and the Internet. You can reach him at **m_nadeau@conknet.com** *or by sending e-mail to* **editors@bix.com.**

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Tucson, AZ
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fax: (520) 670-7101
http://www.artisoft.com

VOS5
Parity Software Development
Sausalito, CA
(415) 332-5656
http://www.paritysw.com/

VoysAccess 1.2
Voysys
Fremont, CA
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http://www.voysys.com/

COMPONENT SOFTWARE

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Redmond, WA
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fax: (206) 93-MSFAX
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Sun Microsystems
(JavaSoft Division)
Mountain View, CA
(415) 960-1300
http://java.sun.com

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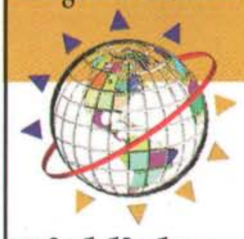

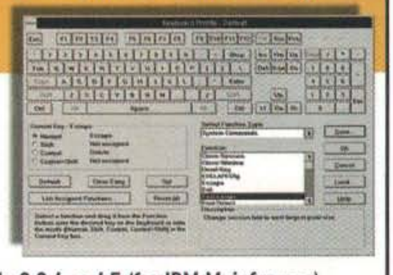

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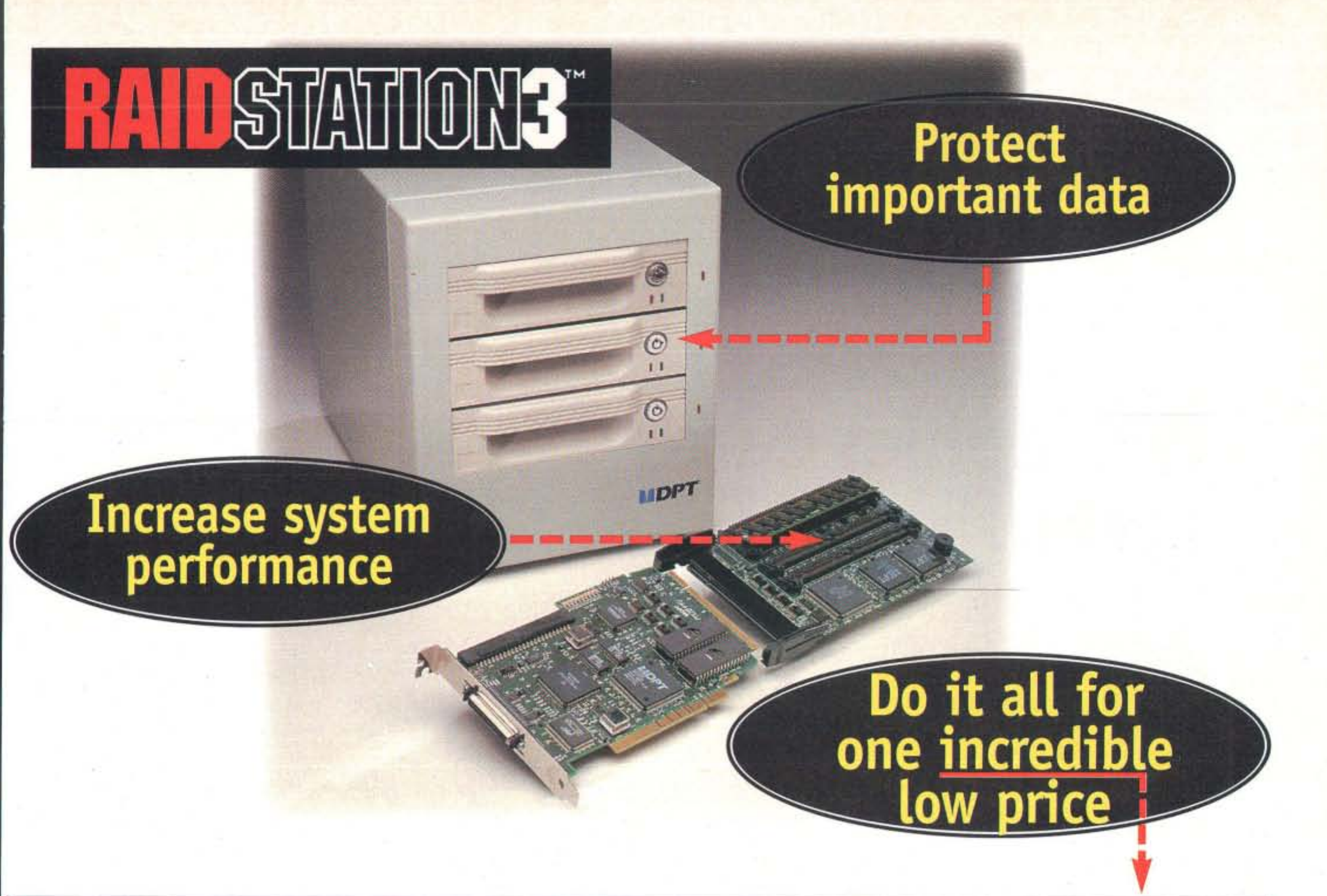
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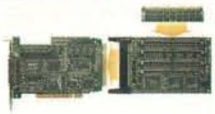


B8702

Circle 141 on Inquiry Card.

13 Graphics Cards for Business

Professional-level 2-D graphics cards grow increasingly sophisticated. Most now have low-end 3-D features.

By Dorothy Hudson, Jim Kane, and John McDonough

If there is one system component that makes the speed of the Windows interface bearable, it is the 2-D graphics accelerator card. We all take it for granted and expect vendors to keep cutting prices, improving performance, and adding new features such as hardware-enhanced video playback and 3-D acceleration. As a result, today's graphics cards not only accelerate Windows applications, they let you view video clips and even play 3-D games. For mainstream professional use, however, it is resolution, color depth, and straight 2-D performance that still matter most.

Coupled with one of the 17- or 21-inch monitors we tested last month (see "Big Screens for Big Jobs," January BYTE), a new graphics accelerator can enhance work efficiency as well as viewing pleasure by increasing the amount of data you can put on one screen. Besides increased performance at high resolution, you get enhanced video playback for multimedia applications and 3-D game acceleration.

Having just tested 13 PCI graphics accelerator cards, we can tell you something about the current state of 2-D graphics performance. All our test cards support 24-bit color at 1024- by 768-pixel resolution or above and with high refresh rates. (This typically requires 4 MB of card memory.) With this in common, there is still much to differentiate the boards in terms of their video and 3-D capabilities. Some also have special features like TV display and support for multiple monitors. The best news is that you don't have to spend much money these days to get a good card.

In fact, our Best Overall choice, the GrafixStar 450 from VideoLogic, costs only $149 when loaded up with 4 MB of memory. The GrafixStar 450 and other low-cost cards like the $159 Hercules Dynamite 128 both provide excellent 2-D performance. At the other end of the price spectrum is the 8-MB Integrated Micro Solutions (IMS) Twin Turbo 128P8, which provides 24-bit color at 1600- by 1200-dpi resolution for $599.

BYTE BEST

GRAPHICS ACCELERATORS

VideoLogic GrafixStar 450

Provided the best 2-D performance of any card we tested—and also had the lowest price ($149 with 4 MB of EDO DRAM). The card uses S3's 64-bit Virge accelerator chip.

Performance Factors

The biggest factor in graphics card performance is the accelerator chip set. In our tests, the best performers use S3's new Virge chip set, which accounted for the three top 2-D performance spots. Not all Virge cards did well: STB's Velocity 3D hung at the back of the pack. Matrox's Millennium, a former champ, still does well with Matrox's MGA-2064W accelerator, and Hercules' Dynamite 128/Video took fifth place using another new chip set, Tseng Labs' ET6000. Architectural bus width—as in 64 bits versus 128 bits—appears not to matter.

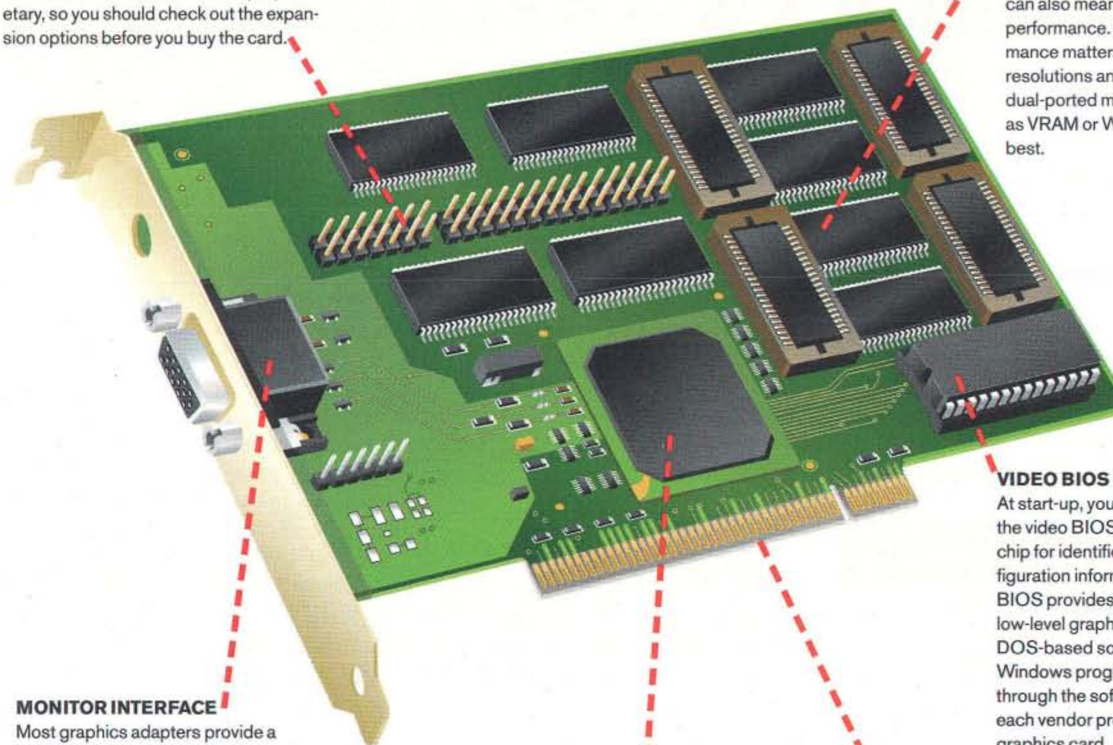
A card's graphics accelerator chip plays a big part in its performance, but so does the Windows driver software. Driver code most likely accounts for the STB Velocity 3D's slower performance compared to other Virge-based cards. The top-notch performers jockey for position from month to month as vendors come out with new driver software.

Having more graphics memory increases capabilities and performance. The type of memory is important, but less so than it used to be. Whereas dual-ported VRAM always provided better performance for higher resolutions and color depths than DRAM, there are newer and less expensive alternatives such as extended data out (EDO) DRAM, multibank DRAM (MDRAM), and synchronous DRAM (SDRAM) that do nearly as well.

3-D and Video Capabilities

The latest graphics cards have on-board 3-D accelerators that mainly aid gaming performance. While development of low-end 3-D graphics accelerators has been driven by the computer games market, the games themselves illustrate how far 3-D graphics has come. As is happening with multimedia, 3-D imaging techniques may eventually turn up in mainstream applications.

3-D acceleration on the graphics card helps the system's CPU turn a mathematical model of a 3-D object into a 2-D representation. Quickly shading, applying texture, and accurately representing object depth affect the speed at which still images are rendered, but these kinds of



EXPANSION CONNECTOR
Some cards have connectors for adding things such as a hardware MPEG decoder. Some connectors are proprietary, so you should check out the expansion options before you buy the card.

VIDEO MEMORY
More memory means higher resolution and more colors. It can also mean somewhat better performance. Memory performance matters most at the high resolutions and color depths; dual-ported memory chips such as VRAM or Window RAM are best.

VIDEO BIOS
At start-up, your system looks to the video BIOS firmware on this chip for identification and configuration information. The BIOS provides a known set of low-level graphics interfaces for DOS-based software. Windows programs interface through the software drivers each vendor provides for its graphics card.

MONITOR INTERFACE
Most graphics adapters provide a single connection to monitors based on the standard D-shell, 15-pin VGA connector. The Matrox cards have a connector for a cable with BNC couplings for the monitor.

GRAPHICS ACCELERATOR
This chip (or chip set) does most of the work, providing hardware acceleration for execution of low-level graphics operations. As with CPUs, higher clock speeds and wider data buses improve performance. Newer chip sets often include hardware assistance for displaying 3-D data and video streams.

BUS INTERFACE
The main benefit to a system with a PCI bus is faster graphics performance. PCI has largely displaced VESA VL and ISA cards, but you can still buy them for older systems.

Illustration based on ELSA's Winner 3000-L

ILLUSTRATION: SANDERS/TIKKANEN DESIGN & ILLUSTRATION © 1997

operations also affect the smoothness of animated 3-D sequences, particularly at greater resolutions and color depths.

For the games market, Microsoft's Direct3D (D3D) API for Windows 95 promises to be important because it provides games developers with a common API that is more or less independent of any graphics chip. All the cards we tested were D3D-capable. The cards that do best on our D3D Tunnel tests, such as the ATI 3D Xpression, the Matrox Mystique, and the Matrox Millennium, are excellent choices for game-type environments.

Microsoft also supports the OpenGL 3-D API in Windows 95 and NT. Current boards have some OpenGL hardware acceleration capabilities, but they still have a long way to go compared to high-end 3-D cards. Our testing for OpenGL showed that some of the cards are faster than others, but there's not much spread.

If you use video clips in multimedia presentations, you should check out a graphics accelerator with MPEG hardware acceleration. It will speed up and smooth out playback by efficiently compressing and decompressing graphics and sound data. The Matrox and Number Nine adapters, and the Virge VX-equipped adapters (STB Systems Velocity 3D, Diamond Stealth 3D 3000, ELSA America Winner 3000-L) have integrated video components, and some others have MPEG options or at least software MPEG players.

The cards with hardware MPEG help attain the full-screen playback rate of 30 frames per second, which provides the appearance of full-motion video. While current MPEG hardware decompression is imperfect, overall it's still better than software-based video playback. Current software MPEG decoders are just on the edge, with performance that's perhaps adequate for short video clips in reference works, such as a CD-ROM encyclopedia. With the availability of TV-tuner daughtercards on some graphics boards, it seems that the sky's the limit for viewing video on your PC screen.

While performance is the primary factor to consider when buying a graphics card, bundled software can make a card easier to configure and use. Most of today's adapters have utilities for installing drivers, changing resolutions on-the-fly, zooming in and panning around the desktop, and even creating virtual desktops larger than the screen.

Contributors
Dorothy Hudson, project manager/NSTL
Jim Kane, project manager/NSTL
John McDonough, technical writer/NSTL
Dave Rowell, senior technical editor/BYTE

Best Overall

GRAPHICS ACCELERATORS

The 13 cards we tested in this Lab Report offer a wide range of capabilities to accelerate your system into the world of multimedia or high-resolution 2-D CAD applications. For our Best Overall ratings, we looked only at the mainstream 2-D performance of the cards. Though many of these cards tout 3-D capabilities, our roundup does not include some of the best low-end Direct3D cards because they don't support 24-bit color at 1024 by 768 resolution. Neither does this report include professional-level 3-D accelerators costing $2000 and up. However, we did measure 3-D performance for both the Direct3D and OpenGL APIs.

With that in mind, we chose VideoLogic's GrafixStar 450 as the Best Overall graphics accelerator. The GrafixStar 450 costs only $149 (as configured for testing with 4 MB of EDO memory). Better than that, the GrafixStar 450 easily performed the best running NSTL's InterMark benchmarks, which measure the 2-D graphics performance you'll get with Windows business applications.

The GrafixStar 450 is based on the 64-bit S3 Virge accelerator chip found on several other cards in this review. VideoLogic credits its fast performance to its well-optimized graphics drivers. Though it doesn't use the video-enabled VX version of the Virge chip, the VideoLogic card can smooth video with the addition of optional hardware-assisted MPEG video via a Scenic/LPB connector (uses S3's proprietary Scenic Highway bus, a high-bandwidth connection that increases performance by keeping the video playback stream off the system bus). The GrafixStar 450 also shines in our features and usability ratings. VideoLogic's SmartTools utility lets you configure your display, set a virtual desktop, and build your own toolbars.

Next in the Best Overall pecking order, and in InterMark performance, is ELSA's Winner 3000-L. It supports 16 million colors at 1280 by 1024 resolution with an 83-Hz vertical refresh rate. The Winner 3000-L gets our highest usability score because it was easy to install and has a complete, well-written user manual. Given that ELSA designs and markets capable 3-D cards, it's no surprise that the Winner 3000-L did well in our OpenGL 3-D testing. Designed for CAD and desktop publishing professionals, it uses an S3 Virge VX 64-bit graphics processor and came loaded up with 8 MB of RAM, which helps to justify its $527 price. The card's 3-D capabilities accelerated Gouraud shading, texture mapping in 24-bit color, and accelerated z-buffering. The Winner 3000-L supports the Direct3D, HEIDI (used in some Autodesk applications), and OpenGL 3-D APIs.

The Hercules Dynamite 128 has the second lowest price ($159) and provides good performance for Windows applications. The card uses a 128-bit Tseng Labs ET6000 accelerator chip with 4 MB

TECH FOCUS 3-D APIs

Will Direct3D Conquer All?

If you follow Internet newsgroups such as comp.graphics.api.opengl, you may have noticed the intense and ongoing debate concerning the relative merits of Microsoft OpenGL, Microsoft Direct3D, and Silicon Graphics' Cosmo OpenGL. The debate, between the principals of the Microsoft OpenGL and SGI Cosmo OpenGL camps but also including other knowledgeable parties, has been intense.

The two OpenGL implementations have very different target audiences. Microsoft maintains that its rendition suits all performance levels, from simple Windows 95 VGA systems to high-performance NT workstations. The software giant offers vendors several approaches to create optimized OpenGL libraries that yield fairly impressive performance. SGI, on the other hand, has targeted Windows 95 systems lacking 3-D graphics accelerators in particular, as an adjunct to its Web applications. Cosmo is a software-only solution that SGI believes can surpass software-only Direct3D implementations. It is also cross-platform, enabling a greater degree of integration among Web applications based on the Cosmo line of products.

Despite differences in their views on OpenGL's future, both parties agree that OpenGL has multiple advantages over Direct3D, and that Direct3D has no lock on the future of any PC 3-D market. Despite its high-end history, OpenGL need not sacrifice good performance for rendering accuracy. For example, OpenGL implementations don't have to provide subpixel accuracy, and OpenGL applications don't have to use it. Like game APIs such as Direct3D, OpenGL can obtain high performance by sacrificing details that aren't necessary in a real-time video environment. Programs running under Cosmo OpenGL have provided performance similar to that of unaccelerated Direct3D. We can hypothesize that accelerated solutions would also be comparable.

Programmers find OpenGL code easier to write and debug. OpenGL presents a completely abstract environment; the programmer can assume that an appropriate screen exists and that OpenGL will make a program's graphics requests fit that screen. Direct3D presents to the program (and programmer) all the hardware details; a program must examine them all and fit itself to that set of features. In OpenGL, all optimizations are in the device driver; any OpenGL program will run on any hardware at any resolution. In Direct3D, you can tune a program to particular screen resolutions, but a particular graphics adapter might not support those resolutions.

OpenGL is not dead in the high-performance games arena, and Direct3D is not necessarily the API of choice for future programmers. What remains to be seen is where each group will take its approach to 3-D graphics and how users will react.

–Steve Platt, manager of electronic publications, NSTL

LAB RESULTS

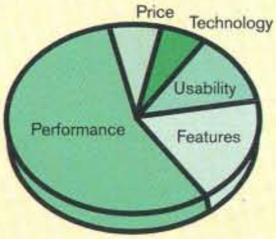
GRAPHICS ACCELERATOR RATINGS

BEST OVERALL

VideoLogic GrafixStar 450

There are many affordable 64-bit graphics accelerators, but few can match the GrafixStar 450's combination of Windows graphics acceleration and low price. Put simply: This is the lowest-priced card we tested and it still has the best performance numbers running NSTL's InterMark benchmark. The GrafixStar 450 uses the 64-bit S3 Virge accelerator chip with a built-in 3-D engine, and it supports up to 4 MB of EDO DRAM. It also supports Microsoft's Direct3D API. VideoLogic backs the GrafixStar 450 with a five-year warranty and a technical support hotline.

WEIGHTING



	PRICE	TECHNOLOGY	IMPLEMENTATION	PERFORMANCE	FEATURES	USABILITY	OVERALL RATING
VideoLogic GrafixStar 450	**$149**	★★★★	★★★★★	★★★★★	★★★★	★★★★	★★★★★
ELSA Winner 3000-L	$527	★★★★	★★★★	★★★★★	★★★★	★★★★★	★★★★
Hercules Dynamite 128/Video	$159	★★★★	★★★★	★★★★	★★★★	★★★	★★★★
Diamond Stealth 3D 3000XL	$299	★★★★	★★★	★★★★	★★★★	★★★	★★★★
Matrox Millennium	$499	★★★★	★★★	★★★★	★★★★	★★	★★★★
Number Nine Imagine 128 Series 2e	$349	★★★★	★★★	★★★★	★★★	★★★	★★★
ATI 3D Xpression+ PC2TV	$219	★★★★	★★★★	★★★	★★★★	★★★	★★★
STB Velocity 3D	$299	★★★★	★★★★	★★★	★★★★	★★★★	★★★
Matrox Mystique	$229	★★★★	★★★★	★★★	★★★★	★★★★★	★★★
Koutech KW-546	$259	★★★★	★★★	★★★	★★★	★★★	★★★
IMS Twin Turbo 128P4	$399	★★★★	★★	★★★★	★★	★★	★★★
Number Nine Imagine 128 Series 2	$499	★★★★	★★★	★★★	★★★	★★★	★★★
IMS Twin Turbo 128P8	$599	★★★★	★★	★★★★	★★	★★	★★★

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

of MDRAM. The Dynamite also surprised us with good OpenGL performance, given that Hercules doesn't supply accelerated drivers for OpenGL.

The Diamond Stealth 3D 3000XL generated impressive numbers in our InterMark and OpenGL tests. The Stealth 3D 3000 pumps it out with S3's Virge VX accelerator chip and 4 MB of VRAM. Matrox's Millennium also provided good 2-D graphics performance.

Direct3D Performance

If you need a good 2-D accelerator that also kicks on games, the Matrox Mystique ($229) provided the best D3D performance in this roundup. Matrox highlights the 64-bit card's fast frame rates for 3-D texture-mapped games, but the Mystique does well enough in 2-D applications. Our test card came with 4 MB of synchronous graphics RAM (SGRAM), which is single-ported memory with graphics-specific features such as block writes and dual bank support. Its dual-bank feature opens two pages of memory at the same time, which accelerates operations such as screen blts, double buffering, 3-D rendering, and video playback. Matrox also offers optional add-ins for hardware MPEG, live video in, NTSC/PAL output, and a TV tuner.

ATI Technologies' 3D Xpression ($219) and Matrox's pricier Millennium ($499) are also strong D3D accelerators. The more affordable 3D Xpression uses ATI's 3D Rage II chip, which accelerates Microsoft's D3D API for fast game action. The 3D Xpression can be fitted with add-ins such as a TV tuner or a hardware MPEG decoder. With its older graphics chip, the Millennium didn't score as high as the Mystique in the D3D tests, but the older card uses 8 MB of Window RAM to prove it can move 3-D frames faster than most cards on the market. With 8 MB of WRAM, you can work in true color at a high resolution of 1600 by 1200 pixels. Like the Mystique, the Millennium has many optional multimedia add-ins and comes with the helpful PowerDesk utility for easy installation.

Under OpenGL

OpenGL is becoming the prevalent API for professional 3-D applications such as CAD and visualization. Both Windows 95 and NT provide built-in OpenGL support. There wasn't much spread in our Viewperf OpenGL test results, but some cards did better than others. The ELSA Winner 3000-L had the top numbers, but the STB Systems Velocity 3D also did well.

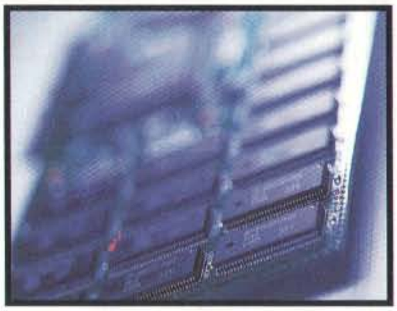
The Velocity 3D ($299) uses an S3 Virge VX chip and comes with 4 MB of dual-ported EDO VRAM that can be upgraded to 8 MB with a 4-MB DRAM module. We tested an 8-MB Velocity 3D. With its fast 220-MHz DAC, the Velocity 3D can support resolutions of up to 1600 by 1200 with respectable refresh rates. This is one of the best cards for NT 4.0 users running OpenGL applications.

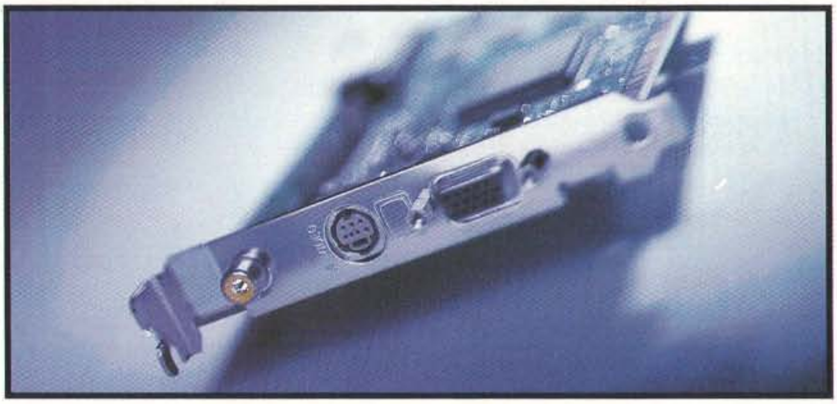
PHOTOGRAPH: BRIAN WILDER © 1997

Details

High-Res True Color

Many of the cards we tested support resolutions up to 1600 by 1200 pixels, some with visually comfortable high refresh rates. Integrated Micro Solutions' Twin Turbo 128P8 (shown below; note the array of memory chips) and Matrox's Millennium have the memory (8 MB) and logic to support that high resolution with 24-bit color (for a palette of over 16 million colors).





What's on Tonight?

ATI's 3D Xpression+ PC2TV has both composite video and S-Video outputs, so you can display software on a large-screen TV—a nice demo setup for a conference room because you can use the same display for both computer and VCR sources. To compensate for the lower resolution on a TV, the card uses antialiasing to keep the image sharp.

With the card's PC2TV feature you can also record computer graphics output to a VCR. This provides an inexpensive and convenient way to distribute multimedia presentations and training materials.

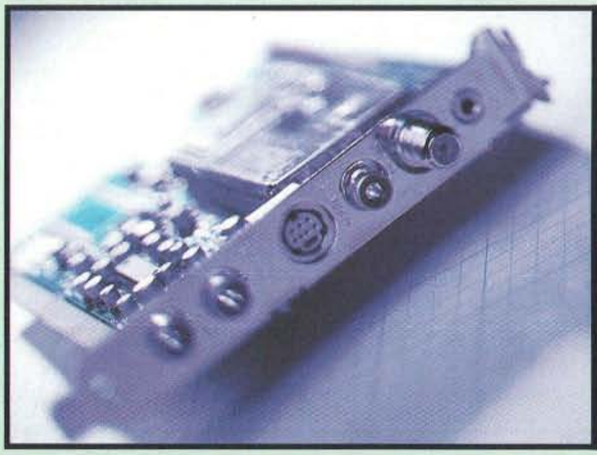
TV Junkie Alert

For information junkies, the ability to surf TV channels while working at a PC can be invaluable. While you won't see TV tuners as a regular system component any time soon, you can buy expansion cards that provide this capability. One that we tested and liked is ATI Technologies' ATI-TV, which we tried in conjunction with ATI's 3D Xpression graphics card.

ATI-TV is an ISA-bus card that connects by ribbon cable to a proprietary connector found on Video Xpression and 3D Xpression graphics cards. The card holds a TV tuner (it's well shielded), a video decoder chip, and a teletext decoder chip. The ATI-TV card has external CATV, composite video, and S-Video inputs. ATI provides Video Player software on a CD-ROM. This capable program supplies a varied suite of functions and appears on-screen as a window that you can fully maximize.

With the card and its software, you can zoom in on video and capture images or movie clips to disk. The card can display closed captioning (NTSC), but it can also store the text, so you can scroll through it later. Also, it can read the captions in the background and pop up the TV image when a caption includes keywords you've specified. The ATI-TV can scan through all available channels and display thumbnails of each program in an array of windows; you click on one to watch in full-screen mode.

You can use the card's video capture feature to grab still or moving images from VCRs, camcorders, and laser discs for multimedia presentations. Your system won't take a performance hit when displaying TV programs because frame rate viewing is achieved with no CPU loading. However, the streaming video capture frame rate will depend on CPU speed, availability of system memory, and hard disk performance.



ATI-TV
$129

ATI Technologies
Thornhill, Ontario,
Canada

(905) 882-2600

http://www.atitech.ca

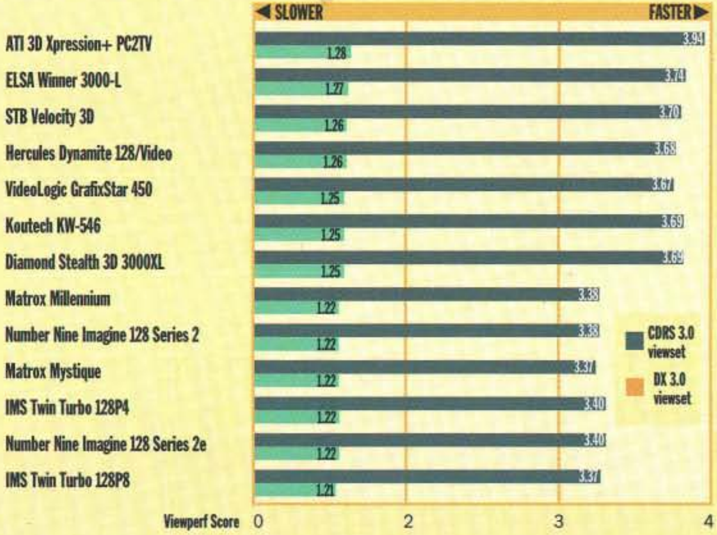
Circle 1099
on Inquiry Card.

Test Specs

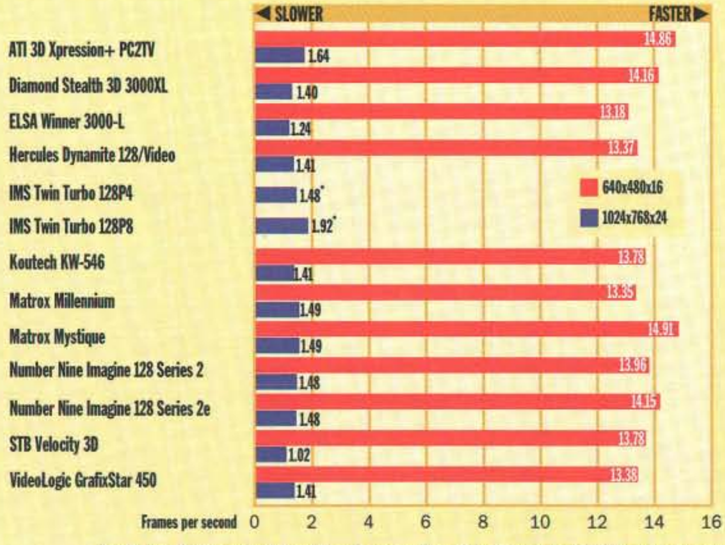
In rating graphics cards, we put strong emphasis on performance. In this roundup, that emphasis is on the kind of 2-D graphics performance that matters with Windows business and professional applications. Because hardware acceleration of 3-D operations is fast becoming a standard feature on 2-D graphics cards, we also tested 3-D performance. We don't yet factor that performance into our ratings process because of Direct3D's debatable worth for business applications and because OpenGL applications are typically high-end. However, you may want a good 2-D card that also works with a program that uses the Direct3D or OpenGL APIs, so we provide the results from our 3-D testing.

We ran the NSTL InterMark test suite to measure the mainstream 2-D performance of the cards. The InterMark tests use images from applications like Corel Draw, Excel, PowerPoint, and Word for Windows, displaying a variety of Windows-based images ranging from straight text to 2-D and 3-D bar charts to complex full-color drawings. We used the InterMark results as the weighted performance portion of our Overall Rating.

Viewperf OpenGL 3D Test Results (1024x768x24)



Microsoft Tunnel Direct3D Test Results



Results from the two modes that most boards can run. Gouraud shading, specular highlights, and texture mapping on.

*Neither IMS board could complete the test in 640x480x16 display mode.

We used the OpenGL Performance Characterization committee's Viewperf to test OpenGL performance, which is important for visualization systems, CAD, and advanced image generation. Viewperf is a freely distributed benchmark with a growing set of application-derived viewing scripts. Viewperf runs the scripts in each data set, or viewset, and measures output in frames per second. Each viewset is rendered in several modes: wireframe, flat surface, smooth surface, and texture mapped. A weighted geometric mean represents how fast the card can render the variety of scenes.

Microsoft's Direct3D Tunnel tests how well a card with Direct3D drivers performs in a game-like environment. We ran it at four different resolutions common for Direct3D systems: 640 by 480 pixels with 256 colors, 640 by 480 with 65,000 colors, 1024 by 768 with 256 colors, and 1024 by 768 in full color. Not all the boards could run all the tests.

Features and Usability

Our ratings include scores for features and usability. Features we value include high resolution and color depth, high vertical refresh rates, and utility software. We gave high usability scores for exceptionally clear and complete documentation and easy-to-use installation software. A card received a good rating if we deemed the average person could install it without referring to the manual.

Evaluations in this report represent the judgment of BYTE editors, based on tests conducted by NSTL, Inc., as documented in a recent issue of their monthly PC Digest. *To purchase a copy of the full report, contact NSTL at 625 Ridge Pike, Conshohocken, PA 19428; (610) 941-9600; editors@nstl.com. For a subscription, call (800) 257-9402. BYTE Magazine and NSTL are both operating units of The McGraw-Hill Companies, Inc.*

GRAPHICS ACCELERATORS FEATURES

	ATI Technologies 3D Xpression+ PC2TV	**Diamond Multimedia Stealth 3D 3000XL**	**ELSA Winner 3000-L**	**Hercules Dynamite 128/Video**	**IMS Twin Turbo 128P4**	**IMS Twin Turbo 128P8**
Price as configured (US$)	$219	$299	$527	$159	$399	$599
Overall Rating	★★★	★★★★	★★★★	★★★★	★★★	★★★
SPECIFICATIONS						
Accelerator chip set	ATI Rage II	S3 Virge VX	S3 Virge VX	Tseng Labs ET 6000	Twin Turbo 128	Twin Turbo 128
Graphics BIOS author and version	ATI	Diamond Multimedia V1.0	ELSA 5.02.00	Hercules A3J	IMAS v. 2107	IMS v. 2107
Video playback chip or chip set		S3 ViRGE VX	Integrated	Integrated	N/A	N/A
Auto bus sensing	✓	✓		✓	✓	✓
Standard RAM/as tested/maximum RAM (MB)	2/4/4	4/4/4	6/6/6	4/4/4	4/4/4	8/8/8
RAM type (VRAM/DRAM)/speed (ns)	SDRAM/35	VRAM/60	VRAM/50; DRAM/40	MDRAM/10	VRAM/60	VRAM/60
Board height × length (inches)	2.5 × 6	6.875 × 4.2	4.125 × 6.875	3.75 × 7.25	5 × 5	7.5 × 9
GRAPHICS CONNECTOR						
BNC						
Supports multiple adapters			✓	✓		
Maximum horizontal frequency	120.6	160	300	100	96	96
Supports DirectDraw (accelerated drivers)	✓	✓	✓	✓	✓	✓
Supports Direct3D (accelerated drivers)	✓	✓	✓	✓		
Supports OpenGL (accelerated drivers)		✓	✓			
3-D ACCELERATOR FUNCTIONS						
Interpolated (Gouraud) shading	✓	✓	✓	✓		
Texture mapping	✓	✓	✓	✓		
Mipmapping	✓	✓	✓	✓		
Z-buffering	✓	✓	✓	✓		
UTILITY SOFTWARE						
Video mode selection	✓	✓	✓	✓	✓	✓
Zoom utility	✓			✓	✓	✓
Board diagnostics	✓			✓		
Adjustable vertical scan	✓	✓	✓	✓		
Adjustable center screen	✓	✓	✓	✓	✓	✓
Windows utility for changing resolution	✓	✓	✓	✓		
VESA BIOS	✓	✓	BIOS	✓	✓	✓
WINDOWS DRIVERS SUPPORT						
16-bit DIB format	✓	✓	✓	✓	✓	✓
32-bit DIB format	✓	✓	✓	✓	✓	✓
Transparent bit maps	✓	✓	✓	✓	✓	✓
Font caching	✓		✓	✓	✓	✓
Supported pixel per inch options	✓	✓			✓	✓
Supported DIB compression	✓	✓		✓	✓	✓
RLE 4	✓			✓	✓	✓
RLE 8	✓			✓	✓	✓
JPEG				✓		
MONITOR SUPPORT						
Digital			✓			
Multisync	✓	✓	✓	✓	✓	✓
Analog	✓	✓	✓			
Multifrequency	✓	✓	✓	✓	✓	✓
Fixed-frequency	✓	✓	✓		✓	✓
GRAPHICS MODES SUPPORTED (ALL NONINTERLACED)						
640 × 480 colors/vertical refresh	16.7 million/200	16.7 million/160	16.7 million/354	16.7 million/120	16.7 million/120	16.7 million/120
800 × 600 colors/vertical refresh	16.7 million/200	16.7 million/160	16.7 million/227	16.7 million/120	16.7 million/120	16.7 million/120
1024 × 768 colors/vertical refresh	16.7 million/120	16.7 million/120	16.7 million/138	16.7 million/75	16.7 million/100	16.7 million/100
1152 × 882 colors/vertical refresh	16.7 million/100	16.7 million/85	16.7 million/109	N/A	16.7 million/100	16.7 million/100
1280 × 1024 colors/vertical refresh	16.7 million/85	16.7 million/85	16.7 million/83	65K/60	16.7 million/50	16.7 million/90
1600 × 1200 colors/vertical refresh	64K/58	65K/80	64K/85	N/A	65K/75	16.7 million/75
APPLICATION DRIVERS (HIGHEST RESOLUTIONS SUPPORTED)						
AutoCAD	1280 × 1024	1600 × 1200	1600 × 1200	1600 × 1200	1600 × 1200	1600 × 1200
Microsoft Windows NT	1600 × 1200	1600 × 1200	1600 × 1200	1280 × 1024	1600 × 1200	1600 × 1200
IBM OS/2 Warp	1280 × 1024	1600 × 1200	1600 × 1200	1280 × 1024	1600 × 1200	1600 × 1200
SCO Open Systems X Window	1600 × 1200	N/A	Optional	N/A	N/A	N/A
CUSTOMER SUPPORT						
Warranty length (years)/coverage	5/P, L, F, R	5/P, L, R	3/P, L, R	5/P, L, R	5/P, L, R	5/P, L, R
Toll-free phone	N/A	(800) 468-5846	(800) 272-3572	(800) 532-0600	(888) 467-8282	(888) 467-8282
Phone	(905) 882-2600	(408) 325-7000	(408) 935-0350	(510) 623-6030	(408) 369-8282	(408) 369-8282
On-line address	http://www.atitech.ca	http://www.diamondmm.com	http://www.elsa.com	http://www.hercules.com	http://www.integratedmicro.com	http://www.integratedmicro.cor
Inquiry number	**1064**	**1066**	**1067**	**1068**	**1069**	**1070**

BYTE BEST = BYTE Best

✓ = yes; N/A = not applicable.

Warranty: P = parts; L = labor; F = freight to repair center; R = return to customer.

★★★★★ Outstanding
★★★★ Very Good
★★★ Good
★★ Fair
★ Poor

Koutech Systems KW-546	**Matrox Graphics Millennium**	**Matrox Graphics Mystique**	**Number Nine Imagine 128 Series 2**	**Number Nine Imagine 128 Series 2e**	**STB Systems Velocity 3D**	**VideoLogic GrafixStar 450** BYTE BEST
$259	$499	$229	$499	$349	$299	$149
★★★	★★★★	★★★	★★★	★★★	★★★	★★★★★
Tseng Labs ET6000	MGA-2064W	MGA-1064SG	Imagine 128 Series 2	Imagine 128 Series 2	S3 Virge VX	S3 Virge
Tseng Labs 0.16	Matrox Graphics Flash BIOS	Matrox Graphics Flash BIOS	Number Nine 3.02.01	Number Nine 3.00.04	STB 1.01	S3 2.3
Integrated	Integrated	Integrated	Integrated	Integrated	Integrated	N/A
	✓	✓	✓	✓	✓	✓
2.25/4/4.5	4/8/8	4/4/4	4/4/4	4/4/4	4/8/8	2/4/4
MDRAM/36	WRAM/60	SGRAM/70	EDO VRAM/60	EDO DRAM/60	VRAM and DRAM/60	EDO DRAM/35
2.9375 × 7.375	3.75 × 7	3.75 × 7	4.25 × 6.875	4.25 × 6.875	3.875 × 8.75	4.2158 × 6.30
	✓	✓				
	✓		✓	✓		✓
80	110	110	135	85	81.7	81.9
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16.7 million/90	65K/200	65K/200	16.7 million/150	16.7 million/150	16.7 million/160	16.7 million/150
16.7 million/90	65K/200	65K/160	16.7 million/150	16.7 million/150	16.7 million/147	16.7 million/120
16.7 million/70	65K/120	65K/120	16.7 million/150	16.7 million/150	16.7 million/120	65K/100
N/A	65K/120	65K/100	16.7 million/150	65K/140	16.7 million/85	65K/90
64K/60	65K/110	65K/75	65K/118	65K/110	16.7 million/85	256/75
N/A	65K/85	256/60	65K/83	256/83	65K/80	256/60
1280 × 1024	1600 × 1200	1600 × 1200	1600 × 1200	N/A	1600 × 1200	1600 × 1200
1280 × 1024	1600 × 1200	1600 × 1200	1600 × 1200	1600 × 1200	1600 × 1200	N/A
1280 × 1024	1600 × 1200	1600 × 1200	1600 × 1200	1600 × 1200	1600 × 1200	1600 × 1200
N/A	1600 × 1200	1600 × 1200	1600 × 1200	N/A	N/A	N/A
3/P, L, R	3/P, L, R	3/P, L, R	5/P, L	5/P, L	Lifetime/P, L, R	5/P, L, F, R
N/A	(800) 361-1408	(800) 361-1408	(800) 438-6463	(800) 438-6463	(888) 234-8750	(800) 578-5644
(310) 699-5340	(514) 969-6320	(514) 969-6320	(617) 674-0009	(617) 674-0009	(972) 234-8750	(415) 875-0606
http://www.koutech.com	http://www.matrox.com/mga	http://www.matrox.com/mga	http://www.nine.com	http://www.nine.com	http://www.stb.com	http://www.videologic.com
1071	**1072**	**1073**	**1074**	**1075**	**1076**	**1077**

Present a Businesslike Slide Show

Today's graphics tools help you present your arguments and data with polish and professionalism.
By David Seachrist

We used to call them business-graphics programs. People used them primarily to create individual, data-driven charts. Over time, these packages shifted their focus to cohesive, multiple-slide presentations organized via outlines and slide sorters. GUIs, especially Windows, were an enormous step forward in producing more elaborate and effective graphics, which enhanced and focused spoken presentations.

For the November 1996 BYTE, NSTL tested a group of multimedia authoring tools that allow the integration of video, sound, and Internet links into presentations. But most presentations don't require that much apparatus, nor the time needed to create it. Thus, there's a firm place for these mainstream presentation-graphics programs: Adobe Persuasion 3.0.2, Corel Presentations 7.0, Software Publishing's Harvard Graphics 4.0, Lotus Development's Freelance Graphics 96 Edition for Windows 95, and Microsoft's PowerPoint 95 7.0.

For this review, we chose programs that offer an individual slide-editing environment, a slide sorter, an outlining environment, extensive charting (including organizational charts), drawing capabilities, and automated slide-show functions. We didn't include programs better-suited for multimedia applications, such as Astound's (Palo Alto, CA) Astound for Windows, or programs designed for more intensive authoring, such as SFD's (San Bruno, CA) Quovis line.

By the time this review sees print, Adobe, Lotus, and Microsoft will have released new updates. Final versions of these packages were unavailable when we did our testing, but we discuss what's coming in these new versions.

Using the Software

With presentation graphics now standard in office suites, it's reaching a more diverse group of end users, and thus creating a demand for still more features and greater ease of use. Therefore, despite all the bells and whistles in these products, NSTL's test scenario is based on an intermediate user who only occasionally creates and gives short presentations—slide shows that include bulleted text charts, data charts, organizational charts, and clip art.

BYTE BEST
PRESENTATION GRAPHICS

Corel Presentations 7.0
This package offers state-of-the-art features, Internet functions, the images and graphics tools that made Corel famous, and usability that's among the best. And, with a price tag under $100, it's a bargain, too.

Some users are most comfortable working with words to organize their thoughts, while others like to organize the slides with a graphical interface. All five reviewed programs help both types of users by offering a word-based outline view as well as a slide-sorter view of a presentation. All five slide-editing environments provide easy access to program commands via screen icons and menu structures.

Presenting on the Web

The ability to save presentations in Hypertext Markup Language (HTML) and publish them to the Web has considerable potential. All software vendors are scrambling to build in Web compatibility, but there's still plenty of room for improvement in every program. Harvard Graphics and Adobe Persuasion currently offer no Web-publishing features.

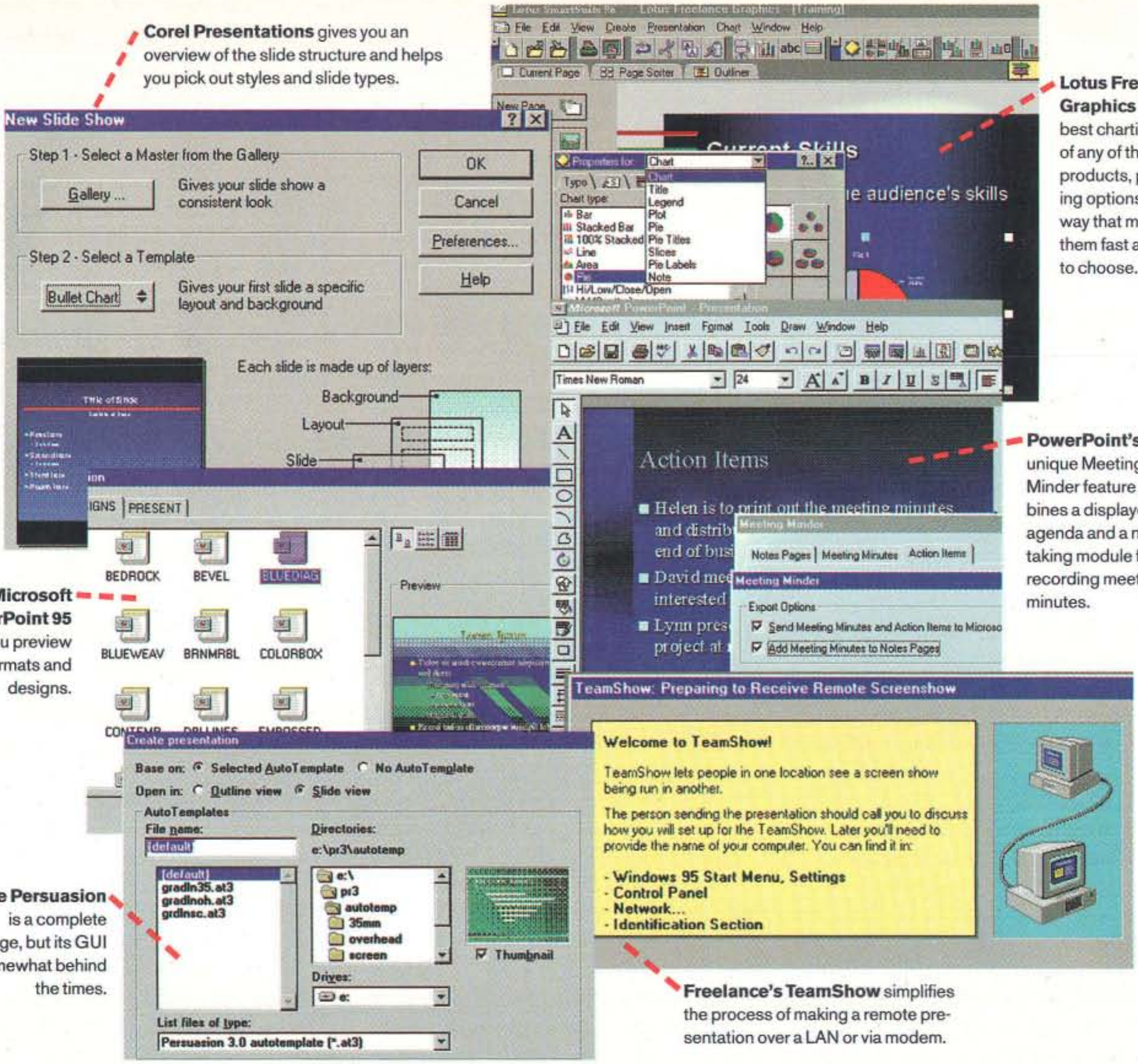
Corel Presentations, Freelance Graphics, and PowerPoint 95 all save to HTML files, but none offers a streamlined method of saving to a Web server. PowerPoint 95 requires an add-in: either the PowerPoint Internet Assistant or the Powerpoint Animation Publisher and Player, both offered free on Microsoft's Web site (http://www.microsoft.com).

Corel Presentations 7.0

Corel Presentations offers state-of-the-art features, Internet functionality, a host of graphics tools, and usability that's eclipsed only slightly by two of the other programs. With a price tag under $100, Presentations is clearly the bargain of the bunch.

Presentations certainly shows its Corel heritage with its extra graphics and drawing features (e.g., the ability to interface directly with TWAIN-compatible image scanners), an automatic bit-map tracing feature, the broadest graphics import/export capabilities, and 10,000 clip-art images. Presentations is the only program of the five that allows pixel editing of bit maps.

Corel performs screen updates faster than any other program in this group, and it's especially impressive with a com-



Corel Presentations gives you an overview of the slide structure and helps you pick out styles and slide types.

New Slide Show

Step 1 - Select a Master from the Gallery

Gallery ... — Gives your slide show a consistent look

Step 2 - Select a Template

Bullet Chart — Gives your first slide a specific layout and background

Each slide is made up of layers:

Background

Layout

Slide

Lotus Freelance Graphics has the best charting tools of any of these products, presenting options in a way that makes them fast and easy to choose.

Microsoft PowerPoint 95 lets you preview slide formats and designs.

PowerPoint's unique Meeting Minder feature combines a displayed agenda and a note-taking module for recording meeting minutes.

Action Items

- Helen is to print out the meeting minutes and distrib...
- David me... interested ...
- Lynn pres... project at ...

Meeting Minder

Export Options

☑ Send Meeting Minutes and Action Items to Microso...

☑ Add Meeting Minutes to Notes Pages

Adobe Persuasion is a complete package, but its GUI is somewhat behind the times.

Create presentation

Base on: ● Selected AutoTemplate ○ No AutoTemplate

Open in: ○ Outline view ● Slide view

AutoTemplates

File name: [default]

Directories: e:\pr3\autotemp

Drives: e:

List files of type: Persuasion 3.0 autotemplate [*.at3]

☑ Thumbnail

TeamShow: Preparing to Receive Remote Screenshow

Welcome to TeamShow!

TeamShow lets people in one location see a screen show being run in another.

The person sending the presentation should call you to discuss how you will set up for the TeamShow. Later you'll need to provide the name of your computer. You can find it in:

- Windows 95 Start Menu, Settings
- Control Panel
- Network...
- Identification Section

Freelance's TeamShow simplifies the process of making a remote presentation over a LAN or via modem.

All these packages offer extensive help in preparing a slide presentation, including style and content templates and wizards, graphics and charting tools, and clip art.

plex Windows Metafile graphic. In print speed, Corel is second only to PowerPoint in returning control to the user.

The templates that come with the program are good, but there isn't the diversity of slide layouts that the other packages offer. Presentations is the only tested program that doesn't allow you to paste in charts and have them take on a template's color scheme automatically.

Presentations lets you break a pie-chart slice into a column chart, which is helpful when you want to show the individual items that make up a slice. The program currently supports chart builds, in which individual chart elements (e.g., the bars in a bar graph) appear in successive slides.

Of all the programs tested, Corel Presentations is the most Internet-ready. It comes with HTML saving capabilities out of the box, and it supports HTML frames, which lets you access individual slides from a page that has both the table of contents and the slide.

Adobe Persuasion 3.0.2

Persuasion has been in this market since the late 1980s, but it's the only program here not designed for Win 95. This hurt it in virtually every scoring criterion. For example, although Persuasion's on-line help is quite complete, the help system's context-sensitivity isn't as intuitive as that of products that are designed specifically for Win 95.

Also, unlike the rest of the group, Persuasion doesn't distribute content outlines, and it doesn't let you browse through clip-art previews to find an image. However, it does have floating text and object tool palettes that allow you to edit while the tools remain on-screen, and it supports chart builds.

By the time this review sees print, Adobe should have unwrapped version 4.0, which will still be targeted mainly at people who make presentations on a regular basis. The new version will be the first major upgrade since Adobe acquired Aldus in 1995.

Version 4.0's most significant features are more distribution options, including more Web presentation functions. But instead of HTML, Adobe will use its own portable document format (.pdf files) for viewing with Adobe Acrobat. Persuasion's interface will move closer to that of other Adobe graphics products, such as Photoshop. And even though the new product will support some Win 95 features, such as long filenames, it still won't be a 32-bit application.

Lotus Freelance Graphics 96

Freelance Graphics 96 is a major upgrade from version 2.1, which NSTL evaluated for BYTE's last report on presentation graphics (in the January 1995 issue). Boosts in charting and collaborative-computing features, as well as interface enhancements, such as live slide thumbnail preview in the outline view, make this a comfortable, feature-rich environment for novice presenters.

The package comes with a wide selection of slide layouts and backgrounds that look beautiful when displayed in 16-bit (64,000 colors) mode. Freelance Graphics offers easy application of slide transitions, but you can't preview the effects.

NSTL's usability testers liked doing live editing with floating tool palettes, which are used in several of these programs, but they found Freelance's Infobox, a floating property dialogue, to be the best interface of the bunch. Because it's context-sensitive, only those commands that apply to the selected object are available to the user. And because you can alter object and text properties in real time, you can see changes happen.

Freelance has a nice selection of specialized diagramming tools. You can create process and conceptual diagrams with the other programs, but Freelance Graphics does most of the work for you.

The program allows point-to-point connection (for two remote computers only) via either modem or a LAN connection, and multipoint capability is planned for the next release of the program. A wizard-like interface made establishing a presentation conference easier than with the other programs.

Freelance Graphics 96 was a major upgrade, and the new features going into the next release aren't spectacular. Freelance Graphics 97 supports HTML frames, and it has a File Save interface for saving HTML files to a Web server. Uniform resource locator (URL) links to Web sites can be accessed directly from a presentation. Lotus adds 14 new SmartMasters to the current 120, and Lotus Notes users will like the enhanced presentation library and review database. The new version continues support for the electronic filing cabinet and now supports Notes 4.0's TeamReview feature.

Harvard Graphics 4.0

Harvard Graphics was the versatility winner in our previous tests, but it has not kept up with the others on the Internet front, and its performance is only slightly above average. In general, we found Harvard Graphics a little less helpful, and its operations required a few more steps, than the other programs. On-line help is complete and well designed, but it lacks a natural-language search engine.

Harvard Graphics' templates are quite good, but there are fewer backgrounds. This is the only product that doesn't allow you to animate bullet items during the build process—for example, to have them bounce onto the screen from the left. Clip art generally has to be ungrouped and the background object made transparent if you want it to take on the background color of the slide, a cumbersome process.

On the plus side, Harvard Graphics comes with Harvard F/X tools, which allows special effects, such as shaping text to curves and extruding and blending graphical objects. Harvard Graphics was the fastest of the bunch, and background color reproduction in the NSTL quality test file was superb. Color text is more impressive in the other four programs, however.

Microsoft PowerPoint 95 7.0

PowerPoint has been a key player in defining and developing presentation graphics since its first appearance in 1987 as a Macintosh application that had no charting or outlining capabilities. But the program introduced the world to WYSIWYG slide formatting and, more important, it promoted the concept of combining many slides into a single file as a coherent presentation. Many of the features and tools that we now take for granted originated with PowerPoint.

PowerPoint 95 is a business communications tool, not just an authoring package, and it's useful for meetings of many kinds. It's currently the only program of this group that allows multiple remote users to view a presentation via a TCP/IP connection with the presenter and audience running the full version of the program. (Unfortunately, the presentation conference feature doesn't work via TCP/IP if your network also has NetWare IPX drivers installed.) And although PowerPoint offers a wizard to set up the presentation conference, users can't browse for computer names.

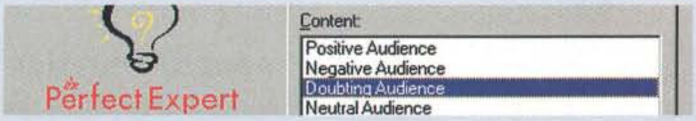
The program goes far beyond the others in one area of meeting use. You can display your meeting agenda as a bulleted list and type minutes directly into PowerPoint's Meeting Minder. The program also

PRESENTATION GRAPHICS

BEST OVERALL

Corel Presentations 7.0

An extensive feature set, great graphics tools, and good usability make this a winner.



	RETAIL/UPGRADE PRICE	TECHNOLOGY	IMPLEMENTATION	PERFORMANCE	EASE OF LEARNING	EASE OF USE	OVERALL RATING
Corel Presentations 7.0	**$95 / N/A**	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★
Lotus Freelance Graphics 96 Edition	$355 / $105	★★★★	★★★★	★★★	★★★★★	★★★★★	★★★★
Harvard Graphics 4.0	$289 / $99	★★★	★★★	★★★	★★★★	★★★★	★★★★
Adobe Persuasion 3.0.2	$395 / $129	★★	★★★	★★	★★★	★★★★	★★★
Microsoft PowerPoint 95 7.0	$339 / $109	★★★★	★★★★	★★★	★★★★★	★★★★★	★★★★

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor N/A = not applicable.

FEATURES

	Adobe Persuasion	Corel Presentations	Harvard Graphics	Lotus Freelance Graphics	Microsoft PowerPoint 95
DESIGN AND CONTENT					
Design and content automation	Design only	✔	✔	✔	✔
No. slide templates: topics/backgrounds/layouts	42 / 0 / 16	11 / 12 (213 CD) / 6	12 / 31 / 15	30 / 120 / 12	19 / 85 / 24
Edit slides globally/individually	✔	✔	✔	✔	✔
No. clip-art images/sound clips/video, animation clips	500 / 139 / 32	10,000 / 471 / 0	500 / 0 / 0	>700 / 17 / 79	>1100 / 137 / 4
OUTLINER					
Import text	RTF	RTF	ASCII	ASCII	RTF
Outline expand/collapse	✔		✔	✔	✔
Number of outline levels	256	8	4	6	5
Preview slide from outliner				✔	97
ELECTRONIC PRESENTATIONS					
Number of transition effects	15	53	13	27	49
Set transition speed	97	✔			✔
Preview transition effects	✔	✔	✔		✔
Presentation rehearsal			Add-on	✔	✔
Bullet building/dimming	✔	✔	✔	✔	✔
Chart builds	✔		✔		97
Animate objects	✔	✔			✔
INTERNET FEATURES					
Open and save to HTML		✔		✔	Free add-in
Save to Internet server				97	97
Support for HTML frames		✔		97	97
Create linked table of contents	97	✔		✔	Free add-in
Include transitions	97			97	Free add-in
Link URLs to slides	97	✔		97	97
Browser plug-in available	97	Limited		97	✔
Multipoint presentations using TCP/IP			On LAN	97	✔
CHARTING					
Number of data-driven chart types	11	10	7	10	9
Breakout pie/column chart		✔	✔		97
Chart assimilates slide master attributes	✔		✔	✔	✔
Graph noncontiguous ranges	✔	✔		✔	✔
Sort pie slices	✔	✔	✔	✔	
Include chart data as table		✔	✔	✔	✔
DRAWING					
Number of drawing tools (/ shapes)	8	15	10	9 / 37	5 / 22
Use shapes with text		✔		✔	✔
Manipulate anchor/control points	Anchor	✔	✔	✔	✔
Image control of bit maps		✔	✔	✔	✔
Rotate objects to any angle	90° increments	✔	✔	✔	✔
Mirror or flip selected shapes	✔	✔	✔	✔	✔
COLORS/FILLS					
Choice of fill patterns, gradations, blend styles	✔	✔	✔	✔	✔
Gradient text and graphics fill	Graphics	✔	✔	Graphics	Graphics
Bit-map text and graphics fill	Graphics in background	Graphics	✔		97
PRINT OPTIONS					
Print outline	✔	✔		✔	✔
Layout, print speaker notes, handouts	✔	✔	✔	✔	✔
FILE MANAGEMENT					
OLE client, DDE	✔	✔	✔	✔	✔
OLE server		✔	✔	✔	✔
Set OLE 2.0 Object options		✔			MO
Add OLE Controls (OCXes)		✔		97	97
Preview clip-art symbols		✔	✔	✔	✔
Open multiple presentations		✔	✔	✔	✔
Automatic file backup		✔		✔	97
File details/descriptions, search		✔	✔	✔	✔
Compress show for transport	✔	✔	✔		✔
IMPORT/EXPORT CAPABILITY					
Number of presentation-import filters	97	3	2	3	3
Number of text-import filters for outliner	7	49	1	1	1
Number of data-import filters for charting	5	5	3	5	3
Number of graphics-import filters	18	29	13	18	17
WORKGROUP SUPPORT					
Automatic routing			✔	✔	✔
Revision management				✔	
Share files between PC and Mac	✔				✔
Simultaneous viewing on LAN		✔	✔	✔	✔
Lotus Notes support		✔		✔	✔
MISCELLANEOUS					
Number of undo levels	1	10	10	10	150
Global search and replace	✔	✔	✔		✔
Macro record and playback		✔		✔	97

✔ = yes; 97 = planned for next version; MO = users can choose to open or edit objects in place.

PRODUCT INFORMATION

Freelance Graphics 96
$355
Lotus Development Corp.
Cambridge, MA
(800) 343-5414
fax: (617) 693-0968
http://www.lotus.com
Circle 976
on Inquiry Card.

Harvard Graphics 4.0
$289
Software Publishing Corp.
San Jose, CA
(800) 336-8360
fax: (800) 582-6000
http://www.spco.com
Circle 977
on Inquiry Card.

Persuasion 3.0.2
$395
Adobe Systems, Inc.
San Jose, CA
(408) 536-6000
fax: (408) 537-6000
http://www.adobe.com
Circle 978
on Inquiry Card.

PowerPoint 95 7.0
$339
Microsoft Corp.
Redmond, WA
(206) 882-8080
fax: (206) 936-7329
http://www.microsoft.com
Circle 979
on Inquiry Card.

Presentations 7.0
$95
Corel Corp.
Ottawa, Ontario, Canada
(613) 728-8200
fax: (613) 761-9176
http://www.wordperfect.com
Circle 980
on Inquiry Card.

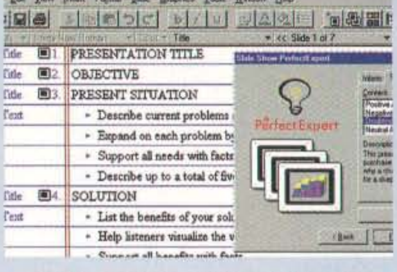
TECH FOCUS TEMPLATES

Anatomy of a Template

Creating your first presentation is a daunting task: There are so many choices, and you're not sure how to proceed. Today's presentation-graphics programs offer considerable assistance, in the form of design templates and content outlines, that help you create good-looking and effective slide shows.

For the design-challenged user, ready-made templates designed by graphic artists provide a fast jump-start. Prior NSTL evaluations of this type of software have shown that testers prefer programs that ease or eliminate design decisions. Step-by-step dialog boxes and automation tools, along with complete, on-line help, assist the user in making such decisions. Whether they're using Corel's PerfectExpert, Freelance Graphics' SmartMasters, Harvard Graphics' Quick Presentations, or PowerPoint's AutoContent Wizard, self-prompting tools give casual business users a much-needed hand in making design decisions.

Template files generally have two tiers, or layers: a background or bottom layer, and a slide-layout layer. Both layers have an effect on the text and graphics that appear on the slide (i.e., topmost) layer. The background layer can contain a graduated or colored fill, a company logo, or other graphics, but its main function is simply to repeat whatever is placed on it on every slide in the presentation. The slide-layout layer determines where to position blocks of text and graphical placeholders on the slide, as well as what text font, size, and style attributes to use.



Title 1. PRESENTATION TITLE
Title 2. OBJECTIVE
Title 3. PRESENT SITUATION
Text
- Describe current problems
- Expand on each problem b
- Support all needs with facts
- Describe up to a total of fiv
Title 4. SOLUTION
Text
- List the benefits of your sol
- Help listeners visualize the v

Corel's content outliner guides you through a presentation.

For the "idea" side of the presentation—adding the content to the design—help was previously limited to providing some organizational tools, such as an outliner. Now most programs also offer professional help in creating and structuring the content of a presentation for specific purposes, such as a sales pitch, a budget proposal, a benefits explanation, and so on. (See the sample slide above.) The programs accomplish this feat by including content outlines for these topics and by using the program's text-placeholder function. Freelance Graphics and PowerPoint 95 offer the best selection of content outlines, followed by Harvard Graphics and Corel Presentations. Adobe Persuasion offers none.

has an Action Items function that creates another bulleted list to remind meeting participants of assigned tasks.

PowerPoint's performance is inconsistent. It's sluggish at performing certain screen updates, but its print spooler is the fastest of all the reviewed programs.

With the new PowerPoint 97, Microsoft is making PowerPoint easier to learn and use while meeting the needs of even more types of users. The Office Assistant is an animated program guru that lets you know if you're performing a task inefficiently and suggests a different method. Experienced users can turn off the Office Assistant.

PowerPoint 97's new and improved organizational tools include an Expand Slide feature that flows bulleted text onto the next slide when one slide becomes too crowded. Also, slide miniatures can now be displayed in the outline view. The drawing tools are beefed up substantially. AutoShapes include five new forms, and the program connects two AutoShapes with a line. Move one shape, and the line automatically stretches and remains connected to the other.

In addition, the Meeting Minder has been enhanced to send action items to the Microsoft Office scheduling program. Finally, the Internet functionality, which now requires add-in programs, is integrated directly into PowerPoint 97.

Good Tools, Every One

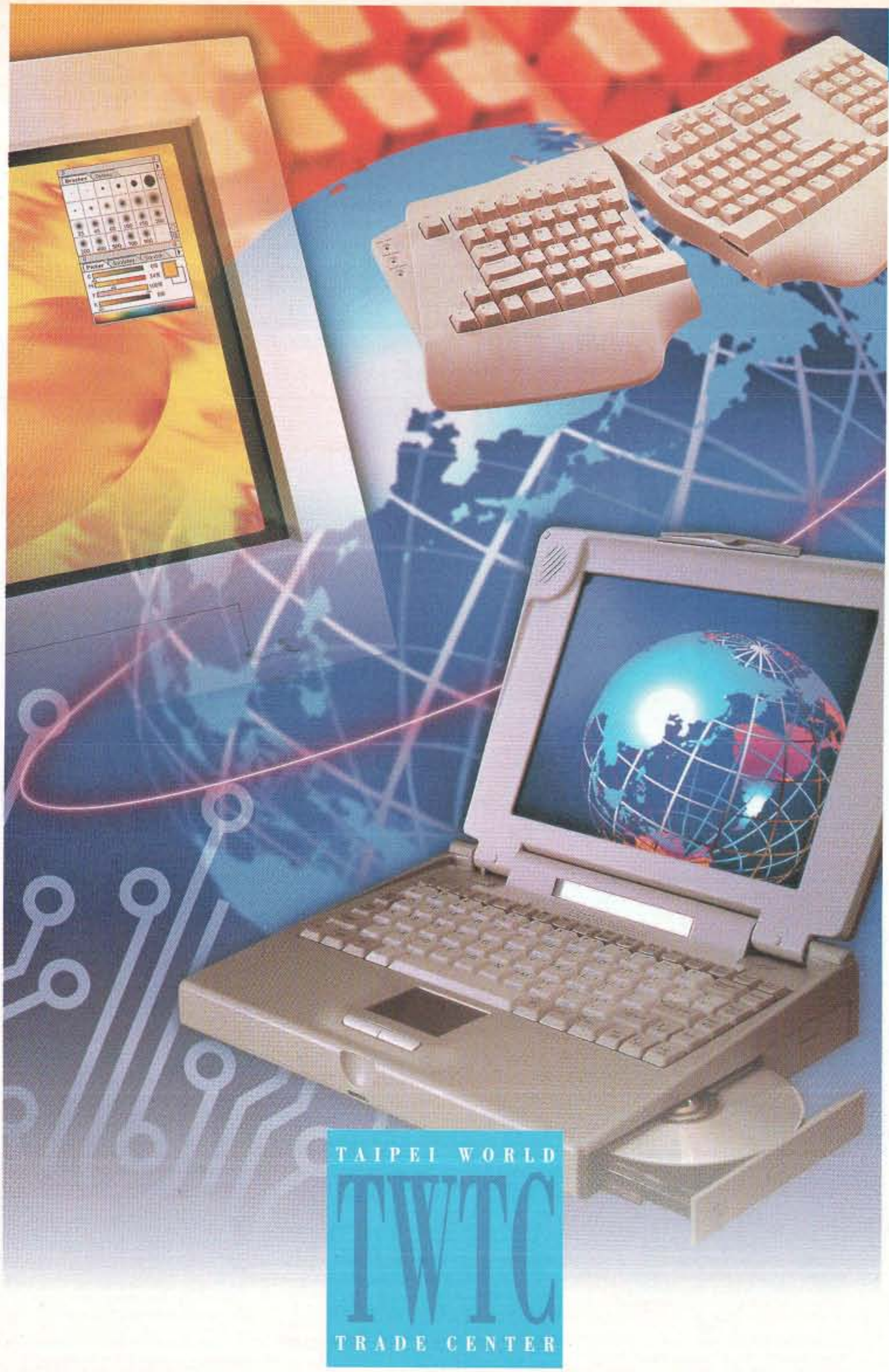
Our tests show that an intermediate-level computer user can create stunning presentations quickly and easily with any of these five products. Lotus's Freelance Graphics and Microsoft PowerPoint 95 are better for novices, while Corel Presentations and Harvard Graphics offer better tools for those with some graphic-design experience.

Corel Presentations, Lotus Freelance Graphics, and Microsoft PowerPoint are all highly capable programs. These three competitors have been leapfrogging one another's feature sets for several years. Each boasts superiority over the others in certain feature categories, but NSTL rates Corel Presentations 7.0 as the features champion.

Harvard Graphics and Adobe Persuasion currently lack the Web-publishing features of the other programs. In the end, there's nothing in any of these packages that would make us suggest that you switch from one to another. But if you're a first-time buyer looking for a presentation-graphics program, Corel Presentations' power, usability, and price make it the pick of the lot. B

David Seachrist has tested all major categories of general business software at NSTL for 10 years, concentrating on desktop publishing and graphics. You can reach him by sending e-mail to **dseachrist@prodigy.com.**

Evaluations in this report represent the judgment of BYTE editors, based in part on extensive tests conducted by NSTL, Inc., as documented in a recent issue of its monthly Software Digest. *To purchase a copy of that report, with NSTL's own evaluations and data, contact NSTL at 625 Ridge Pike, Conshohocken, PA 19428; (610) 941-9600; fax (610) 941-9950; on the Internet, editors@nstl.com. For a subscription, call (800) 257-9402. BYTE magazine and NSTL are both operating units of The McGraw-Hill Companies, Inc.*



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EtherPower 10BT PCI	117.39
EtherPower 10/100BTX PCI	139.04
TigerStack 10BT 12-port hub	489.58
TigerStack 10BT 26-port hub	858.25

DATA STORAGE

COLORADO MEMORY SYSTEMS INC.

Jumbo 350 350MB TBU internal	45.82
T1000E 800MB TBU external	159.18

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Zip drive 100MB parallel	199.95
Zip drive 100MB SCSI	199.95
Ditto Easy 800MB Travan internal	99.95
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Jaz drive 1GB cartridge	124.95
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SONY

SDT-5200 DDS-2 DAT internal	676.90
SDT-5000 DDS-2 DAT internal	995.48
SDT-5000 DDS-2 DAT external	999.37
SDT-7000 DDS-2 DAT internal	926.30

SyQuest

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EZ135 135MB external	119.23
EZ135 135MB cartridge	19.99
EZFlyer 230MB SCSI external	289.47
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MULTIMEDIA

ADS Cadet AM/FM stereo data receiver	66.15
ADS TV Superscan 2 PC to TV converter	289.13
Connectix QuickCam for Windows	97.36
Connectix Color QuickCam for Windows	219.91
EXP 8X CD w/game port PCMCIA	377.51
EXP 8X CD w/sound module PCMCIA	498.84
Microsolutions 4X CD parallel	219.67
Microsolutions 6X CD w/sound parallel	357.76
Microsolutions 8X CD parallel	289.08
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NEC 6Xi 6X CD internal	239.82
NEC 8Xi 8X CD internal SCSI-2	227.17
NEC 8Xe 8X CD external SCSI-2	308.75
Panasonic portable 4X CD SCSI	299.00
Sony portable 4X CD Discman®	299.98
SunMoonStar 8X CD internal IDE/ATAPI	135.24
SunMoonStar 8X CD portable	269.88

INPUT DEVICES

Alps Desktop GlidePoint	66.86
Alps GlidePoint Windows 95 keyboard	95.58
Calcomp Drawing Slate II 6x9 w/pressure pen	195.34
Calcomp Drawing Slate II 12x12 w/pressure pen	219.41
Epson PhotoPC digital camera	399.00
Epson ActionScanning System II	376.41
Epson ES1000C color scanner	584.67
Epson ES1200C Pro color scanner	1138.56
Hewlett Packard ScanJet 4s	198.41
Hewlett Packard ScanJet 4p	499.90
Hewlett Packard ScanJet 4c	857.90
Kodak DC20 Digital Science Camera	199.00
Kodak DC25 Digital Science Camera	499.00
Kodak DC50 Digital Science Camera	899.00

INPUT DEVICES

Logitech MouseMan 96	55.51
Logitech Cordless MouseMan 96	61.22
Logitech SurfMan Internet controller	84.58
Logitech TrackMan Marble	84.76
Logitech PageScan Color Pro scanner	307.76
Microtek PageWiz compact scanner	98.17
Microtek ScanMaker E3 color flatbed	309.26
Microtek ScanMaker E6 std. color flatbed	556.72
Microtek ScanMaker 35t Plus	729.66
Play Snappy video still capture	195.97
Umax PageOffice Color scanner	239.88
Umax Vista-S6E scanner	289.93
Umax Vista-S12 scanner	709.21
Visioneer PaperPort Vx scanner	277.21
Visioneer PaperPort ix scanner	289.92

MONITORS

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Mag Innovision DX1795 PnP 17" .26mm	629.55
Mag Innovision DX15T 15" .26mm	394.49
Mag Innovision DX1795E 17" .28mm	529.00
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Magnavox CM2015 15" .28mm	299.87
Magnavox CM1215 15" .28mm	316.80
Magnavox 107B 17" .28mm	574.43
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NEC XV15+ 15" .28mm	429.81
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Sony Multiscan 17seII 17" PnP .25mm	929.76
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ViewSonic PT810 21" .30mm	1634.19

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ATI Video Xpression Plus PCI 2MB	98.87
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Matrox Millennium PCI 4MB WRAM	249.15
Matrox Mystique PCI 2MB WRAM	167.71

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Intel OverDrive DX4/100	179.34
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Intel OverDrive Pentium 166MHz upg for 5/100	456.23

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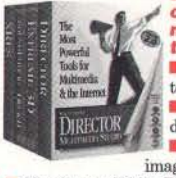

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J50 5/133 8MB 800MB 10.4" active	1899.00
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5300 5/133 16MB 1.35GB 12.1" active	4399.00
5380 5/133 16MB 2.16GB 12.1" active	5499.00
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Acculogic SIDE-3+ w/on-board BIOS	37.45
Adaptec AVA1505 SCSI-2 CD Kit	48.42
Adaptec 1542CP SCSI Master Kit	249.65
Adaptec PCI Ultra Wide SCSI Kit	289.83
Promise EIDEMAX ISA 2HD on-brd BIOS	25.28
Promise EIDE2300+ VLB 4HD on-brd BIOS 6550	49.42

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Hayes

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ACCURA 336 V.34 external w/fax	149.29
ACCURA 336 DSVD internal	168.17
ACCURA 336 DSVD external	184.51
ACCURA 336 V.34 voice internal	158.77
OPTIMA 336 Business Modem external	239.56

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BitSURFR Pro ISDN terminal adapter	346.69
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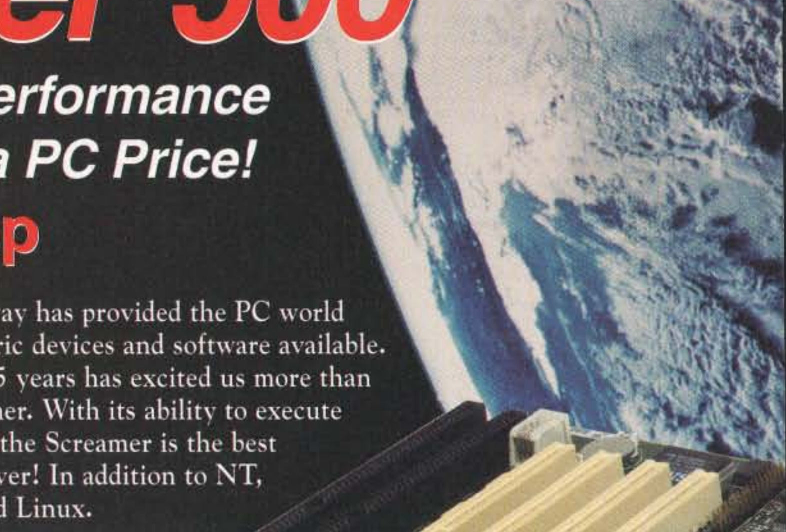

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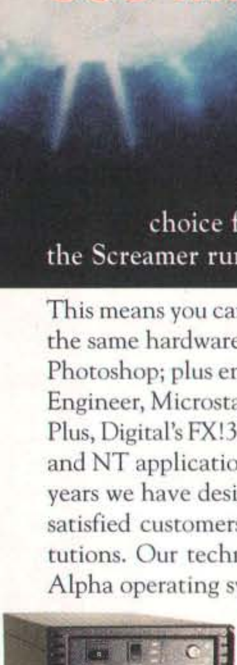

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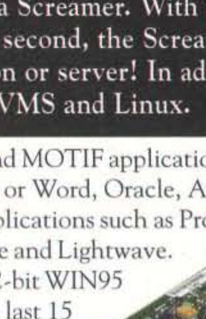

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Jon Udell

Web Project

NT Security

Seven practical recommendations for securing Internet-connected Windows NT systems.

In my August 1995 column, I mentioned that Satan, the Internet security scanner, had probed a Windows NT server on The BYTE Site and found no vulnerabilities. But as I pointed out then, no scanner can find holes that it doesn't know how to look for. Satan tests for well-known weaknesses in Unix installations, but it was clueless when it came to finding security holes in my Internet-connected NT system.

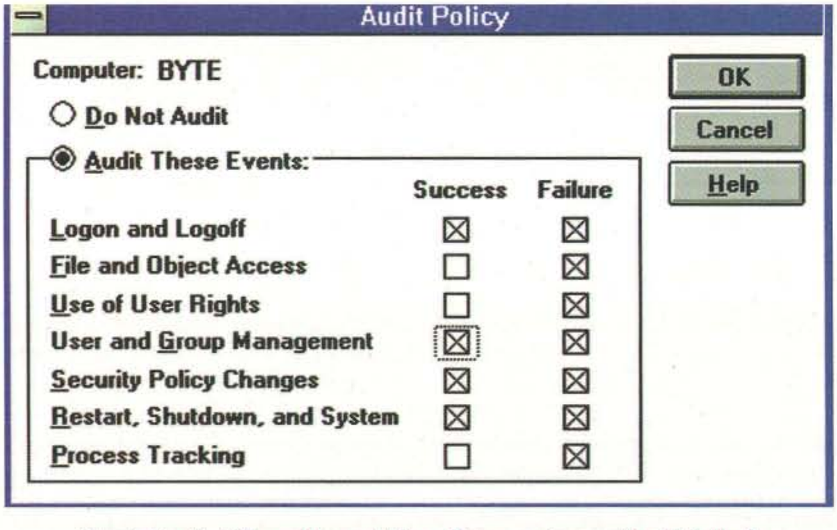
In this case, I'd purposely left a NetBIOS share wide open. Anyone who was running Windows 95 and knew a little about Windows networking over TCP/IP could have typed `NET USE Q: \\SERVERNAME\SHARENAME` and gained full access—across the Internet—to the server's boot partition.

Does that make NT less secure than Unix? Today the answer is yes, but not because NT is inherently less securable than Unix. Administrators of Unix systems have learned over decades how to configure Unix to survive in the hostile environment of the open Internet. As NT increasingly finds itself operating in that same hostile environment, its administrators have to master the same techniques. Here, then, are some ways to make an NT site less vulnerable.

1. Use NTFS, Not FAT

NT File System (NTFS) volumes can apply access-control lists (ACLs) to files and directories; these controls work in conjunction with permissions on shared directories. A file allocation table (FAT) volume supports only the latter, share-level form of security. For safety's sake, it's always the best thing to layer multiple defenses whenever they're available, so you should always use NTFS on Internet-connected Windows NT machines.

If NTFS ACLs give a network user full access to a partition but share-level permissions grant only read access, then the effective access is read only. Windows NT takes the intersection of NTFS ACLs and share permissions.



Computer: BYTE

○ Do Not Audit

● Audit These Events:

	Success	Failure
Logon and Logoff	☒	☒
File and Object Access	☐	☒
Use of User Rights	☐	☒
User and Group Management	☒	☒
Security Policy Changes	☒	☒
Restart, Shutdown, and System	☒	☒
Process Tracking	☐	☒

By default, NT audits nothing. Be sure to audit all failed operations, as well as low-frequency successes.

Should you even allow shares to exist on a public machine? Ideally not, but in practice you need some way to move files to and from your server. NTFS-level security can help make that practice less dangerous. If you create new shares, though, be sure to alter the default permissions assigned by NT. If you forget, group "Everyone" will have full control of all that's visible through the share.

This behavior is one of the reasons why NT gets a bad rap in the security community. It tends to default to a friendly configuration rather than to a paranoid one. That philosophy may be appropriate for a LAN workgroup, but it's disastrous for an Internet server.

What if you're already running FAT? On x86 (but not RISC) NT systems, you can upgrade a boot volume to NTFS—in place—using the CONVERT utility. It's scary, but when I tested CONVERT on a development server to verify that it works, all went well.

2. Rename the Administrative Account

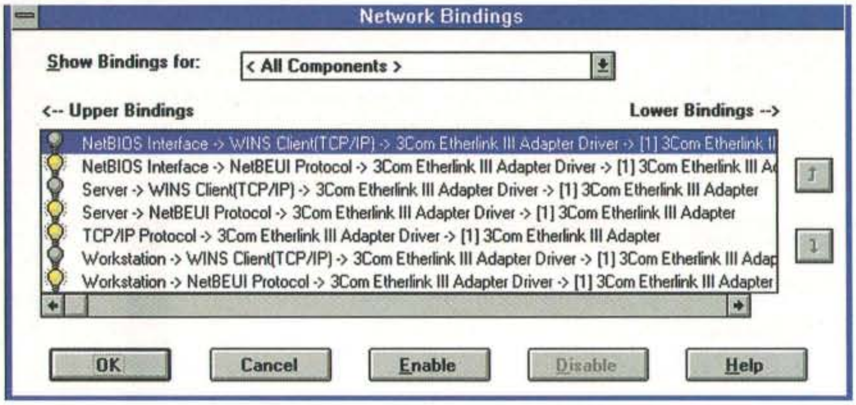
To foil brute-force password-guessing attacks, you should use NT's User Manager to set an account-lockout policy. For example, the policy might specify that NT will lock out an account after five failed log-on attempts. Unfortunately, the most dangerous account—the administrator's—is exempt from this policy. Even if you transfer administrative rights to your own account and use only that ac-

PHOTOGRAPH: KELLIE WALSH © 1997

count for NT administration, the built-in administrative account remains available (because it can't be deleted or disabled) and vulnerable to brute-force password attacks (because it can't be locked out).

Many NT experts recommend that you rename the administrative account something obscure (e.g., 789Az0qPPaGzwer79) rather than the default name Administrator. That way, a password-guesser must first guess the account's name.

The renaming function is not available from User Manager's User Properties dialog box, an omission that confused not only me but also a Microsoft product manager I interviewed. To rename the administrative account, select the User->Rename menu choice in User Manager.


Network Bindings

Show Bindings for: < All Components >

<-- Upper Bindings
Lower Bindings -->

NetBIOS Interface -> WINS Client(TCP/IP) -> 3Com Etherlink III Adapter Driver -> [1] 3Com Etherlink II
NetBIOS Interface -> NetBEUI Protocol -> 3Com Etherlink III Adapter Driver -> [1] 3Com Etherlink III Ad
Server -> WINS Client(TCP/IP) -> 3Com Etherlink III Adapter Driver -> [1] 3Com Etherlink III Adapter
Server -> NetBEUI Protocol -> 3Com Etherlink III Adapter Driver -> [1] 3Com Etherlink III Adapter
TCP/IP Protocol -> 3Com Etherlink III Adapter Driver -> [1] 3Com Etherlink III Adapter
Workstation -> WINS Client(TCP/IP) -> 3Com Etherlink III Adapter Driver -> [1] 3Com Etherlink III Adap
Workstation -> NetBEUI Protocol -> 3Com Etherlink III Adapter Driver -> [1] 3Com Etherlink III Adapter

Disconnecting NetBIOS, Server, and Workstation from the TCP/IP stack guards against many NBT-based over-the-Internet attacks.

While you're at it, disable the Guest account and remove or restrict all other user accounts. A machine dedicated to providing public Internet services does not need, and should not have, user accounts other than those required for its administration.

Finally, if you're running NT 4.0, you can use a utility provided in the Resource Kit to activate lockout for the built-in administrator's account. It's effective only for over-the-network log-ons; if it's triggered by an attack, you can still log on locally to reset the lockout.

3. Turn On Auditing

How do you know if you've been attacked or broken into? NT's event-auditing system can help, but only if it's enabled—and by default it is not. In User Manager, the Policies->Audit menu choice leads to a screen that controls auditable events.

The trick here is to collect enough information, but not too much. You can audit both the success and failure of various operations. Failures occur less often than successes, and they're usually more interesting from a security perspective, so I always capture all these events (see the screen on page 117). I also capture successes for infrequent operations—such as Security Policy Changes and Restart—that might reflect unauthorized activity.

NT permits you to track other successful operations—File Access, Use of User Rights, and Process Tracking—but you'll need massive storage to capture this data, and incredible diligence to analyze it.

However you decide to audit your system, it's crucial to review the event logs to understand what records NT writes under normal conditions. That baseline will help you spot changes that spell trouble.

Experts also recommend that you guard the audit logs, because hackers typically try to cover their tracks after a break-in. You could schedule a periodic backup of the log files, but if the backups remain on-line, then they, too, are vulnerable. A better solution would be to echo the audited events to a printer, or even e-mail them to yourself, to create an irrevocable audit trail. How? NT Perl comes with a (slightly buggy) module that you can use to read the event log. (See http://www.byte.com/art/download/evt.pl for a sample program that lists recent event-log entries.)

4. Disable NetBIOS-over-TCP/IP

An Internet-connected NT box will, by default, support Windows networking over two transport protocols: NetBEUI and TCP/IP. What's Windows networking? All the operations that require syntax of the form \\NAME. These operations include directory and printer sharing, NetDDE, and remote administration. Connecting to a drive or editing a registry across the Internet requires only a mapping, in the local LMHOSTS file, between the remote machine's NetBIOS name and its IP address. For instance, you can use Win 95 versions of Event Viewer and User Manager (these come with the NT Resource Kit) to manage NT servers across the Internet. This setup is very convenient for administrators—and also for hackers.

The good news is that NT enables precise control over your use of NetBIOS-over-TCP/IP (NBT). You can go to the Bindings dialog box in the Networks control panel and disable any or all of the following bindings between NetBIOS-based services and TCP/IP (see the screen at left).

On several machines, I've disabled all three. On one machine, though, I've allowed the `Workstation->TCP/IP` binding to remain, because its job requires it to connect locally to a Linux server that shares directories using Samba.

Because NT networking services run promiscuously over multiple transports, my machines can still talk to each other using Server, Workstation, and other services. But these conversations occur only on the NetBEUI channel, which does not go across the Internet.

The bad news? Hackers can't try to remote-mount drives or remote-edit registries—but neither can I.

5. Block Nonessential Inbound TCP/IP Ports

Suppose an attacker did break in somehow and gain administrative control. He or she might then find a way to reenable the NBT bindings you'd so carefully disabled. So, it's a good idea to enlist your router as another line of defense.

I'm assuming here that your NT server is highly exposed—outside your firewall if you have one—and that its mission is to offer public services, such as Web and FTP. If that's the case, only two inbound paths need to exist from the router to the server: HTTP on port 80, and FTP on port 21. The router can, and probably should, block all other inbound traffic.

You may or may not have the access and/or the authority to adjust your router's packet-filtering rules. If you can do so, you might be tempted to create a back door for yourself. You could, for example, reject all non-Web and non-FTP inbound

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traffic, except NBT traffic on ports 137, 138, and 139 coming from the IP address that you use for remote administration.

In theory, only you could then remotely operate the server. In practice, a hacker who discovered the connection between you and that IP address could also try to exploit the inbound path.

How might someone learn the IP address of your home system and exploit it? An acquaintance outlined his MO as follows: 1) research the target server's administrator, 2) create a phony Web page tailored to the administrator's interests, 3) send an e-mail invitation to visit that page, 4) capture the IP address of the home system, and 5) infiltrate that system using JavaScript or ActiveX.

A back door that depends on the anonymity of an IP address is frighteningly vulnerable to a patient, systematic attack. That's why security experts recommend that you disallow all nonessential inbound paths. Bob Lord, Netscape's chief security consultant, wryly laments this evil necessity: "Rather than telnet in at 3 a.m. from my den while sipping a hot cup of coffee, I have to drive to work and sit in the cold room...but I'm not bitter."

6. Revoke the "Access from Network" Privilege

There's another line of defense available in NT. By default, NT grants to group Everyone the right to Access from Network. You can revoke this right—thus blocking all Windows networking services—yet still support Web service. An NT Web server, for example, runs either as SYSTEM or as a local user; in either case, there's no notion of a remote user in the NT sense.

The FTP server that comes with NT will fail in this situation, because it requires users to perform network-style log-ons. But other FTP servers, including the one in Microsoft's Internet Information Server (IIS), perform local log-ons and so are unaffected by revocation of the Access from Network right.

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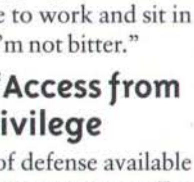

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Unfortunately, unlike the NBT method, this technique cannot select which protocols to allow or deny. So, if you run Web and FTP service with Access from Network revoked, you'll block file-sharing not only across the Internet but also locally over NetBEUI. Here's a compromise solution: Grant only your personal administrative account the Access from Network right.

7. Don't Blithely Divulge Information

"On the Internet, nobody knows you're running Windows NT," say NT partisans. Unfortunately, the curious can easily find out. For example, the built-in FTP service announces connections thusly:

```
ftp> open ftp.myhost.com
Connected to ftp.myhost.com
220 ftp Windows NT FTP Server
        (Version 3.51).
```

Legitimate users have absolutely no need for such information. Hackers, however, gladly use it to disqualify fruitless modes of attack and zero in on effective, OS-specific ones. The IIS FTP service has an equally distinctive signature:

```
Connected to ftp.myhost.com.
220 ftp Microsoft FTP Service
        (Version 2.0).
```

In either case, it's a snap to find out that you've connected to an NT box and to discover which version of NT it's running. Contrast this with my Unix hosts, which announce the following:

```
Connected to ftp.myhost.com.
220 ftp FTP server Version
        wu-2.4(2)
```

It's not obvious whether you've connected to my Linux server or to my BSD/OS server. Even this approach isn't perfect, because there are attacks specific to the wu FTP server. The point: Don't give away any information that you don't have to give away. Although you can customize a greeting message in NT's built-in FTP server and the IIS FTP service, I'm not aware of a straightforward way to suppress or alter the connection banner. If you've figured that out, please let me know.

Give NT Paranoia

Most of the defenses I've outlined here are simple, but they all require some effort. Out of the box, NT configures itself for a trusting environment. When you locate an NT server on the Internet, the governing principle must be paranoia, not trust.

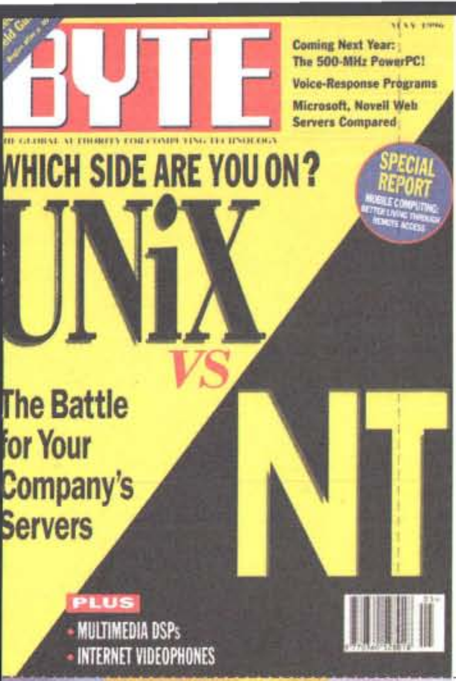
It's not hard to do the kinds of things I've outlined here. What *is* hard is to discover these methods in the first place and then apply them rigorously. But isn't that just what computers do well?

I'd like to make a simple choice—trust or paranoia—when installing or configuring NT. If I choose paranoia, the NT installer should omit all unnecessary network services, protocols, and bindings; revoke all network-based rights and permissions; and audit itself aggressively. On an upgrade, features not consistent with the paranoid mode should be removed so that attackers cannot reenable them. The burden should be on me to selectively install and enable essential capabilities.

A basic tenet of computer security states that whatever is not explicitly allowed should be denied. NT gets this principle mostly backward today, but it shouldn't be hard to implement a "paranoid toggle." Such an option would make public deployment of NT a whole lot less risky. How about it, Microsoft?

Editor's Note: *Thanks to the security consultants who helped with this article: Steve Turcich (independent) and Andy Baron (Midwest Commerce Systems, Inc.,* **http://www.omna.com/***). See also* **http://www.somarsoft.com/**.

Jon Udell is BYTE's executive editor for new media. You can reach him by sending e-mail to **jon_u@dev5.byte.com**.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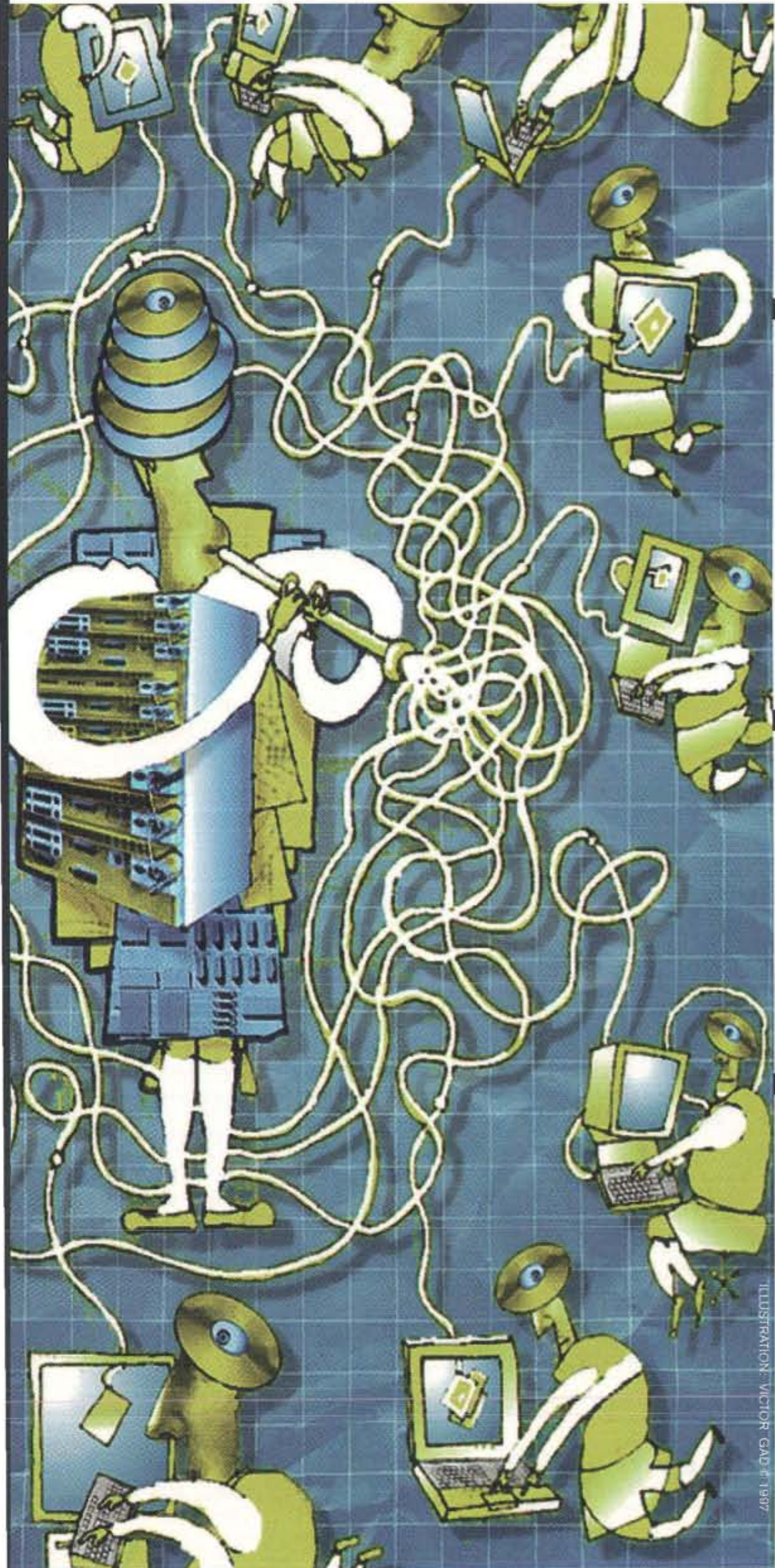

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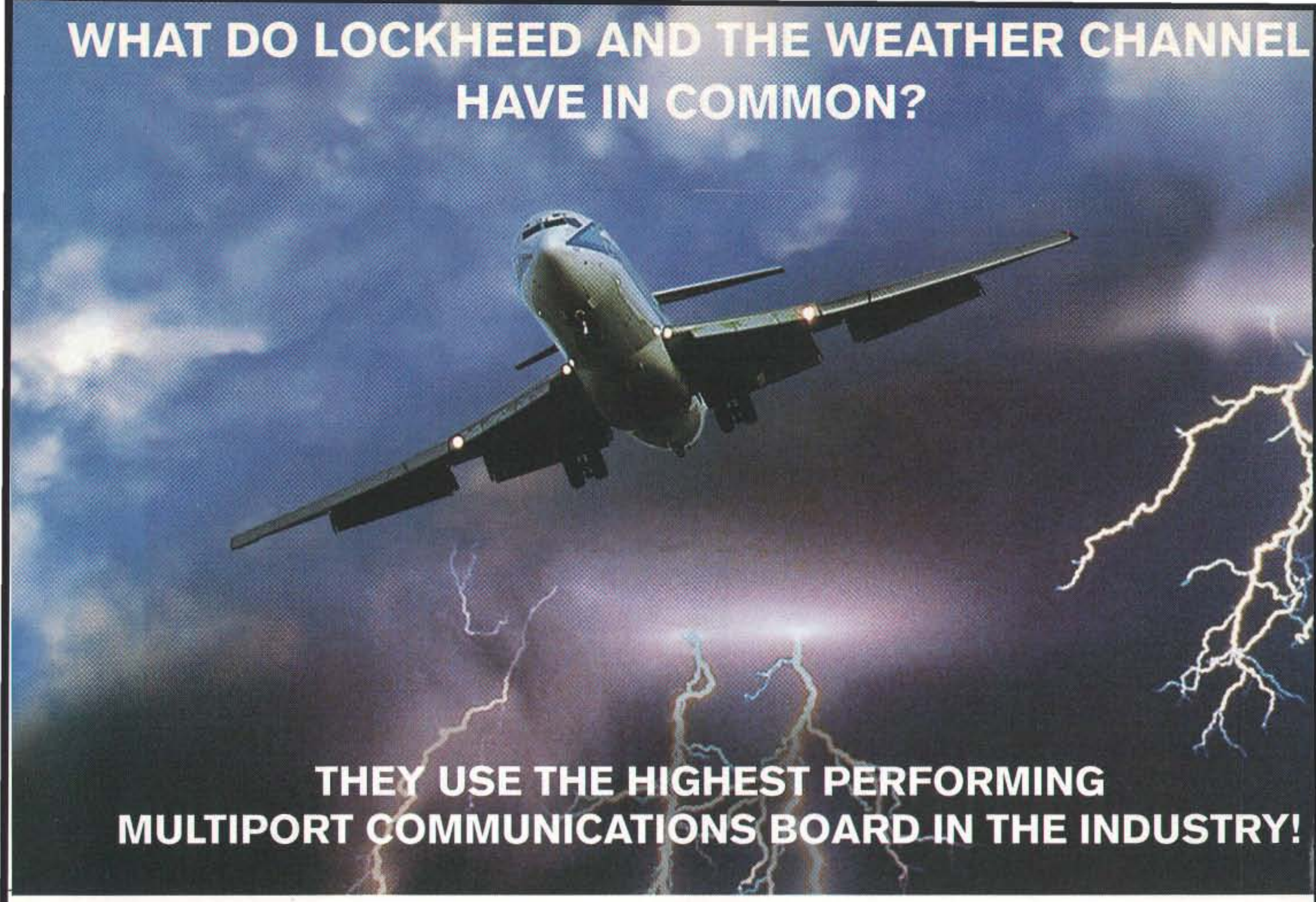

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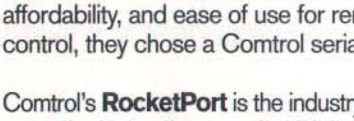
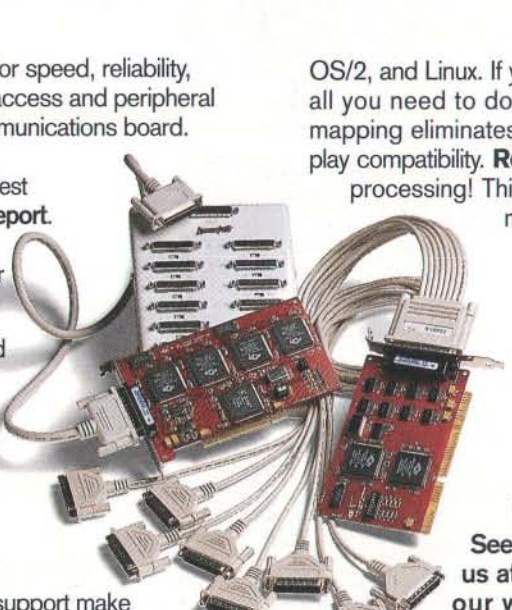
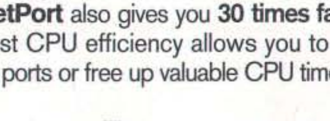


Comtrol's software drivers and technical support make it **easy to switch.** We provide drivers for Novell Netware Connect, Multiprotocol Routing, Windows NT RAS, UNIX, OS/2, and Linux. If you are already using one of these drivers, all you need to do is install your **RocketPort** card. I/O mapping eliminates memory conflicts and allows plug and play compatibility. **RocketPort** also gives you **30 times faster** processing! This host CPU efficiency allows you to add more ports or free up valuable CPU time.





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Share the Wealth

Spreading CPU power around with applications servers makes more sense than ever. ***By Robert L. Hummel***

Large corporations are downsizing from mainframes while demanding the same or better level of performance. Workgroups are upsizing while demanding an increasing level of service. Making these changes possible in many enterprises are applications servers, which promise improved performance, cost control, reduced drain on the network, and easier expansion and manageability. IS departments are embracing dedicated applications servers as never before. This computing model is a far cry from the host-based systems that were pervasive 30 years ago. It's also distinct from the strict desktop client model centered around personal computers. It is, instead, a network-centric model based on specific, dedicated servers and oriented toward global deployment of applications.

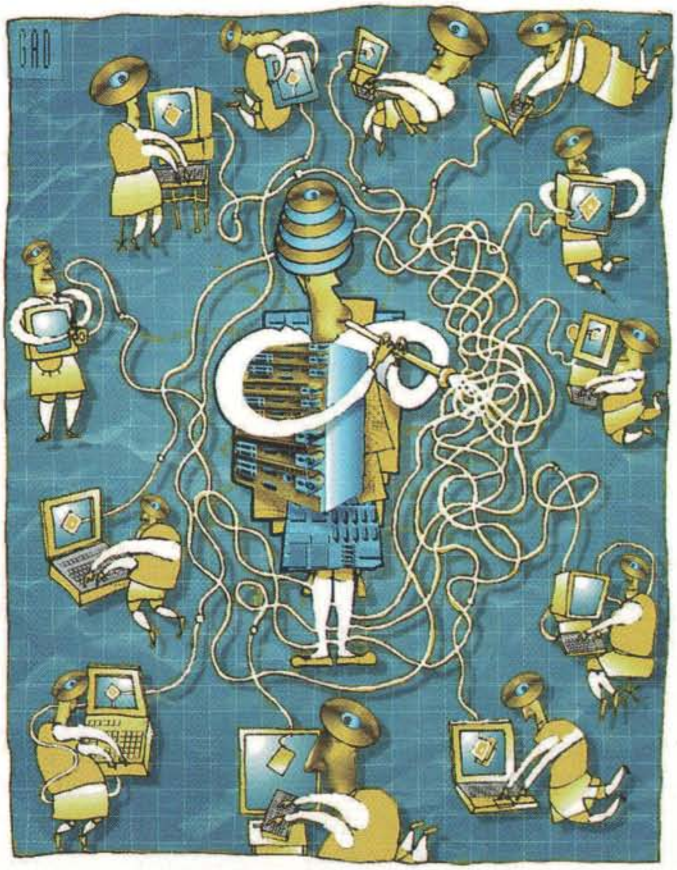


ILLUSTRATION: VICTOR GAD © 1997

Applications servers are often the glue that holds a distributed environment together. But choosing the correct server for your particular needs demands equal parts analysis and vision. Better performance is always a goal when reengineering a network. But other factors figure high on any applications server checklist: reducing implementation cost, ease of development, and integration into the existing network environment.

No single solution is a perfect fit for every company, and legacy systems mean that few IS managers have the luxury of launching applications servers from a clean slate. Choosing the right solution for any particular operation still requires you to sift through confusing and often contradictory information. In this report, we'll examine the spectrum of applications server solutions from x86-based PCs to high-end RISC systems and from server operating systems to applications server suites.

What, exactly, is an applications server? The definition often depends more on who's doing the defining than on the underlying technology. Vendors of mainframe and midrange computers define their systems as applications servers because these systems run core business programs such as billing, inventory control, sales analysis, general ledger, and payroll.

Vendors of increasingly powerful PC servers also define their systems as applications servers. After all, these systems now incorporate many high-end management and development features and can also run core business applications. But unlike their high-end cousins, PC system vendors tend to be more egalitarian in their definition of an applications server: They broaden the category to include, in addition to traditional business applications, productivity tools such as Lotus Notes.

So who's right? Both can be right. And both can be wrong. Applications servers sit somewhere between the data, which resides in a repository like a database, and the client, which is on the user's desk. In other words, applications servers are part of a client/server architecture.

Not every activity performed by a server can be called an application. And not every distributed application can be called client/server. A file server, for example, doesn't qualify because the client isn't aware the server's there. The client talks to a redirector that sends client requests to the file server.

Client/server operation is a logical concept and doesn't depend on physical topology. In a true client/server system, significant processing occurs in both the client and the server processes—regardless of where those processes are executing. Interaction between client and server is cooperative. Typically, a client sends a request to a server. The server, in turn, responds to that request. Both the client and the server portions of a distributed application are aware of each other and communicate as peers. Unlike the case with a file server, neither portion of a distributed application performs useful work without the other. The client and the server typically implement a cooperative balance of work that trades off the computing power available on each platform against network traffic.

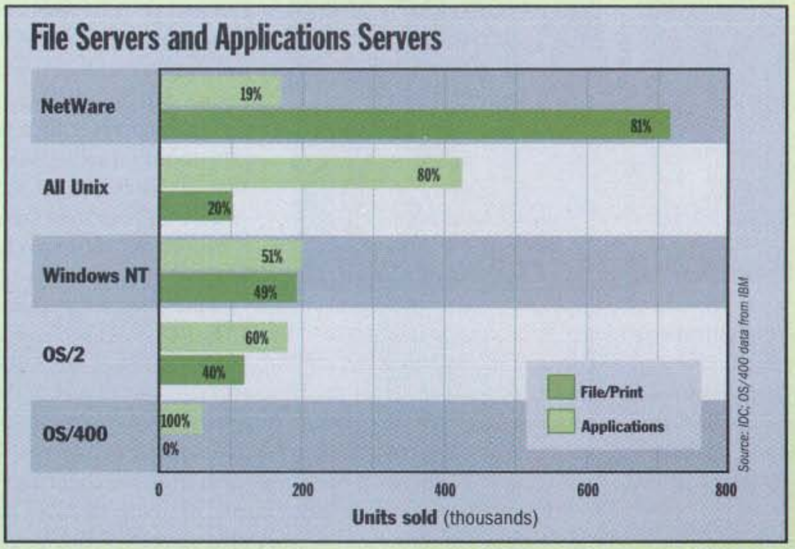
In a two-tier architecture, desktop clients connect to a server on a LAN. Such an architecture enables users to access one set of data. There's a problem, though: The server is responsible for retrieving data and often for applying business rules on that data. For example, a client requests some data, and the database server is responsible for retrieving the data as well as making sure that the user is authorized to see it. Add too many clients and the server gets overwhelmed.

A three-tier applications server model logically (not necessarily physically) separates the user interface, application logic, and data management components. This model removes the responsibility for retrieving and processing data from a single server. As the number of clients grows, you can add second-tier servers to maintain response time. You can even split large databases across multiple servers to further balance third-tier network traffic and service requests.

Apps Servers Today

Mention applications servers and it's likely the application that springs to mind will be database access. But the office does not function by databases alone. More often than not, communication across the room or across the world depends on a suite of productivity servers.

- **Electronic mail.** Although not always a critical line-of-business application, e-mail is currently the most widely used network application. Messaging, a superset of e-mail, enables users to participate in collaborative computing applications such as scheduling, notifying, conferencing, and forms routing. Examples include Lotus Notes, Microsoft Exchange, and Netscape Mail Server.
- **Internet access.** Whether to support controlled access to the Net, establish a corporate presence, or support roving users, a connection server is becoming a mandatory part of any network system. The connection server passes on requests from client browsers, acting as a proxy to remote servers, possibly caching often-accessed pages to improve performance. And clients outside the enterprise can easily access documents. Examples include Netscape Proxy Server, Trusted Information Systems' Gauntlet Internet Firewall, and Microsoft Internet Information Server.
- **Communications.** Homogeneous networks are rare. To enable servers to communicate and share resources across a variety of hardware and software platforms, regardless of protocol, some sites use a communications server. Routing is a critical component that ties users, servers, networks, and sites into a single, coherent network.
- **Network management.** Along with enhanced capability comes increased complexity. Network management systems are designed to collect information about the network and its components and display that information where managers can manipulate it. An ideal system gives IS personnel the ability to manage the network from any workstation, remote connection, or Internet terminal.



File Servers and Applications Servers

Source: IDC; OS/400 data from IBM

Fistful of Benefits

Deploying servers in these ways can improve performance and manageability at all levels of the enterprise. Here are some potential benefits.

- An applications server can off-load all or parts of a mainframe's applications to departmental servers, improving performance without requiring costly upgrades to the mainframe. The lighter load may also extend the productive life of the mainframe and preserve the development investment it represents.
- The improved balance between local and remote processing chores can lower the required communications bandwidth.
- Enterprise-wide distributed computing and advanced database applications become generally available to network users. The improved access can increase productivity.
- Users see improved or more consistent response time. Local servers can cache frequently used data when appropriate.
- Corporate headquarters can synchronize data architectures at remote sites with replication products.
- Multiprocessor, multitasking servers support scalability at a lower incremental expense.
- Independence between client and server components ensures that modification of one need not affect the other.
- Administration can be centralized at the workgroup or enterprise level as appropriate for each application.

Applications servers make a lot of sense. They're a logical bridge between the highly centralized, secure mainframe environment and the decentralized LAN environment, combining the best of both.

The remainder of this Special Report will give you guidelines for evaluating and choosing the operating system and hardware platform that will best suit the needs of your applications server. ■

Robert L. Hummel is an electrical engineer, programmer, and consultant. You can reach him at **rhummel@monad.net.**

Which OS?

Seven key criteria can help you choose the best OS for your applications server.

By Robert L. Hummel

Each OS has something to recommend its place in your server closet. To maintain order, however, you must limit the total number of OSes you run. Let's look at how to choose an OS for your applications servers, with particular attention to NetWare, OS/2, OS/400, Unix, and Windows NT.

Applications Availability

Key questions: Will the OS run the applications you run today? How many new applications are being developed for it now? How much will you pay for the applications you want to run?

Applications availability isn't a numbers game. For all you know, those 11,000 applications that a particular OS supports are all games. Make sure that the applications you need are available. Also make sure that the applications and their support contracts won't be more expensive than the server was–a legacy of the days of the mainframe.

Also look for the OS to support applications interaction in a standard way. For example, NT lets applications pass information among each other using OLE.

Platform Support

Key questions: Does it support your existing clients? How does it support mobile users? Do clients require any special software to access the server?

Interoperability exists on several levels. At the lowest level, systems may define and use divergent network protocols. NetWare networks use IPX, while most Unix networks and the Internet use TCP/IP. By default, NT uses NetBEUI. All these OSes can support other protocols, but they usually work best running their core protocol.

At a higher level, even if a client supports a server's low-level protocol, it still may not be able to connect. A classic example is that you can run AppleTalk on a NetWare 4.11 server, but a Mac that tries to log on without first loading the NetWare client for Macintosh will receive an error telling it that the serv-

SunSoft Solaris

Solaris runs on x86 systems and the Sun line of RISC-based SPARC platforms. Among Unix vendors, only Sun offers a product for multiple platforms. This puts Sun in a unique position as the Unix vendor that can match Microsoft's multiplatform strategy.

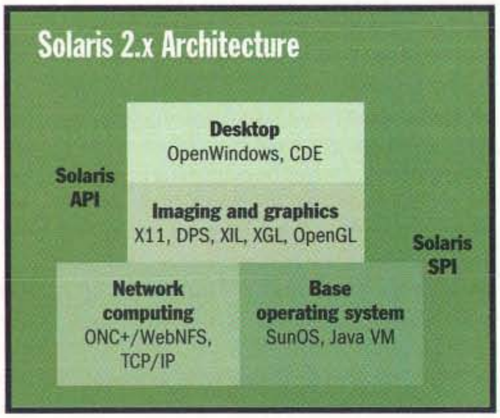
Applications There are 10,000 native Solaris applications available from ISVs covering a range from accounting to Z-mail. Desktop productivity tools such as presentation software tend to be a bit limited, but Sun's Windows Application Binary Interface (Wabi) technology lets many Windows productivity applications run on SPARC/UltraSPARC.

Platform Support Sun's flagship line of SPARC/UltraSPARC CPUs is where you're most likely to find Solaris running, but you can bring it up on any x86 (486 or higher) CPU. Solaris's connectivity resources are formidable, ranging from the enterprise-capable NIS+ directory service, LDAP, and a host of IP networking services (e.g., FTP, DHCP, HTTP, and NFS). If your goal is to connect PCs and Macs to a Solaris server, you're either going to have to install a good TCP/IP client package on each client or install third-party extensions to Solaris. Connectivity to mainframes is another third-party extension.

Performance Solaris running on SPARC is a high-performance hardware/software combination available on everything from laptops to servers with up to 64 processors. The Solaris kernel is incredibly tunable, letting you create a server that is particularly good at a specific task. In fact, you pretty much must tune the kernel to get the best performance from Solaris on applications such as Web serving. Performance on x86 systems generally lags behind the SPARC systems.

Management Whether you're sitting at the graphics-enabled console of your server or at a VT100 that's more than 3000 miles away, you can administer a Solaris system. The Solaris product comes with its own graphical tools for the administration of nearly all its services. Many of these graphical tools are making their way to Hypertext Markup Language (HTML), so you'll soon be able to administer Solaris from any Web browser. However, that doesn't mean that Unix's command-line administration tools have gone away.

Development SunSoft WorkShop provides visual tools, drivers, and libraries for applications development. Sun empha-



At each level of the OS, Solaris isolates applications from each other.

er doesn't have a recognizable log-on sequence. NT's AppleTalk implementation, on the other hand, appears as a standard Mac server.

Look for integration with particular types of directory services. The idea is for users to be able to log on once and to be able to access any applications residing on your applications servers. For example, Unix systems tend to rely on the Domain Naming System (DNS) and the Network Information Service (NIS). NetWare 4.11 uses the NetWare Directory Service (NDS). NT 4.0 also uses a domain system. None of these work well with each other, but some, such as NDS, can accept many OSes into their structure.

The Web may make some of these points moot by standardizing on communications protocols such as HTTP and TCP/IP. For now, however, the best solution for cross-platform integration is either for a server OS to support all the protocols you run in your organization or for you to standardize on a protocol (probably TCP/IP). NT seems to be adept at running multiple protocols, including TCP/IP, NetBEUI, IPX/SPX, and AppleTalk (not to mention a few others), but you can usually find extensions to any OS to bring this level of functionality to your server.

Performance

Key questions: How many users can you support with a single system? Does the OS support symmetric multiprocessing (SMP)? Does it let you balance loads across multiple systems?

You can read all the benchmark results you want, but how an OS performs for you will depend on how you use it. Performance is applications-dependent. Some benchmarks, such as the Transaction Processing Council's TPC-C, indicate system performance in a database environment. Others, such as the BYTEmark, show the performance of specific system components.

Some aspects of OS design indicate what kind of performance characteristics you can expect. Multithreading, for example, can reduce the number of context switches your applications have to do, thereby boosting performance. Preemptive multitasking will let applications cut each other off, delivering more egalitarian performance. NT, OS/2, OS/400, and SunSoft Solaris are both. NetWare is neither.

Next, look at scalability, specifically SMP. All the major OSes—Unix, NT, NetWare SMP, OS/2, and OS/400—support SMP. The question is: How many CPUs can the OS handle? For example, NT's end-user license sizes Java development. Source code compatibility enables Intel-SPARC cross-platform development.

Reliability Solaris's protected-memory architecture makes it a fairly difficult OS to crash completely, and the journaled file system means that crash recovery is smooth. With add-ons, Solaris will support RAID 0, 1, and 5, and two-way clustering. Third-party solutions provide data replication and hardware failure detection.

Security C2 compliance is at the top of Solaris's security laurels. In addition, the administrator can set disk-storage limits, expire and lock accounts, force password changes, and lock user log-on times. Unix as a whole, however, has some serious security holes, such as the sendmail daemon. Patches exist to many of the known holes, but it's up to the administrator to apply them.

Microsoft Windows NT Server

Regardless of the current makeup of your network infrastructure or your inclination, it's nearly certain that NT Server will be a part of your future plans—it does too many things too well for you to ignore it. Expect it to make inroads as a replacement for NetWare and as a low-end and midrange applications server.

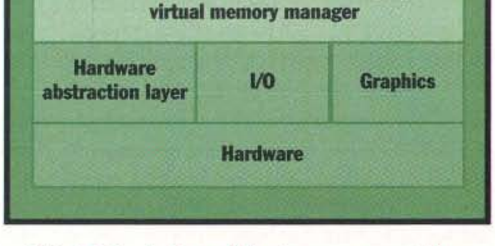
Applications A large number of Windows applications are available, with an increasing number that leverage the 32-bit or multiprocessing nature of NT. High-end business-critical applications (e.g., CICS) are somewhat underrepresented, but Microsoft's BackOffice suite provides good integration of many server applications, including systems management and a database.

Platform Support NT is available for x86 (486 or higher), Digital Alpha, and PowerPC processors. (R4x00 support has been discontinued.) It includes support for most common clients except Unix, which requires a third-party add-on. It uses trusted domains for its directory services, which provide only limited scalability and are incompatible with such standards as X.500 and LDAP.

Performance You can get NT running on some of the fastest processors around, but there are some caveats to NT's multiprocessing. For example, NT can support up to 32 processors, but you'll find the license for the shrink-wrapped version of NT is limited to four. Beyond that, porting is vendor-dependent.

Management The collection of Windows-based management tools is also easy to use, but they lack some of the integration you'll find in a product such as NetWare 4.11. For example, Disk Administrator and User Administrator are separate tools. Also, you manage Macintosh file services not through the Disk Administrator or Windows NT Explorer, but through File Manager. Remote system management support needs improvement, but it can be accomplished with tools such as Symantec's Norton PCAnywhere32.

Development Consistency is the catchphrase when developing for NT. You can develop applications in a single environment that's produced and controlled by a single vendor. NT's momentum translates directly into an abundance of develop-



NT 4.0 isolates all but some graphics applications from the hardware.

limits it to four. OS/2 can address up to 64, as can some Unix implementations. Remember, though, that you often need to tune software to run on SMP systems.

Management

Key questions: Can you control multiple servers from a single point? Can you gain remote-administration access to a server? Does the server integrate with your existing administration system?

Systems management means different things to different people. For many, backup is a key part of systems management. All server OSes have some kind of backup utility built in. Unfortunately, they're not always the most sophisticated packages, and they all have different interfaces. If your goal is to back up your disparate servers from a central console and you've already selected software such as Arcada's Backup Exec, make sure it supports the new OSes.

As you plan for your network's growth, be sure that the OSes you choose fit in with your management scheme. If the network will never be large, you may be able to rely on Unix's command-line interface. If, however, you're responsible for a server farm with several dozen boxes, you need some way to get an at-a-glance summary of the farm's status.

Software such as Intel's LANdesk Manager and Symantec's Norton Administrator for Networks can give you a sense of what's going on with your servers. However, they don't have great support for OSes such as Unix and OS/400. Alternately, standard SNMP consoles such as Hewlett-Packard's OpenView can give you information about the flow of information around your network, but they often can't get you component-level information about particular systems.

The basic rule with management is to make sure that whatever OS you choose fits in with your existing management strategy, or that you're willing to modify your strategy to accommodate the new OS.

Applications Development

Key questions: Are the development tools you use available for this platform? Does the OS vendor extend support to users or only to independent software vendors (ISVs)? Are the APIs open and well documented?

Off-the-shelf productivity is an enticing concept, but it's one that translates poorly into reality. Except at the simplest level of operation, every network will require some customization. An OS must have standard OS services and industry-standard interfaces to support development. Virtual development tools, languages, and development systems all geared to producing Windows applications.

Reliability NT's fault tolerance runs from integrated RAID 0, 1, and 5 to automatic restart after a crash. Clustering is available from companies such as Digital and Tandem. Microsoft is working on a clustering API (called Wolfpack), but initially it will support only clusters of two systems.

Security NT implements most of the common security features, including password restrictions, account expiration, and audit logs. NT 3.51 has C2 certification for standalone systems, but not for networked systems, and NT 4.0 has no C2 certification.

Novell NetWare

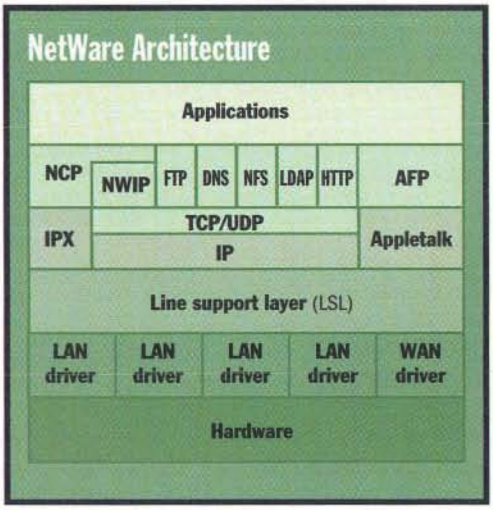
Novell is the first to admit that NetWare might look somewhat threadbare as a client/server applications-server platform compared to other offerings. Its capacity to provide comprehensive transaction processing is thin. Until the addition of support for SMP for multithreaded applications last year, it offered limited scalability. IntranetWare, a new offering from Novell, is essentially an upgraded version of NetWare 4.11. It adds a Java virtual machine, a TCP/IP-IPX gateway, and an integrated multiprotocol router for WAN and Internet connections.

Applications About 6000 applications are available for NetWare, including popular network-centric and workgroup productivity applications. That said, the nature of the NetWare loadable module (NLM) architecture means third-party applications tend to be complete solutions, offering integration within themselves, but integration with each other and the OS is poor.

Platform Support NetWare runs only on x86-based (386 or higher) systems. Client connectivity is good, with built-in support for DOS, Windows 3.1, Windows 95, NT, Mac OS, and OS/2. You will have to configure the server to support long filenames, however, and you'll have to train Mac users how to log on to the NetWare NDS tree.

Performance Single-server performance is limited by the fastest x86 processor you can buy, because NetWare SMP does not automatically make its SMP capabilities available to all applications.

Management The NetWare administrator runs under Windows 3.1, NT, Windows 95, and OS/2. It makes user, group, and directory tree management as well as volume administration simple. To shut down the server, however, you need to be at the console or using the DOS-based remote-console utility included with the OS.



NetWare development lacks an open-interface model.

Development NetWare is not a great development platform. In particular, the lack of an open-interface model and shortage of development tools and documentation have hampered development, although companies such as Oracle and Lotus have designed their products as NLMs. The NetBasic scripting language enables building server-based logic. Novell's IntranetWare initiative emphasizes Java as the development environment and may provide some improvements.

Reliability NetWare file servers have a well-earned reputation tected memory, multitasking, preemptive scheduling, and advanced features (e.g., threads and asynchronous I/O) are essential to many high-end development efforts.

To make productive use of an OS's customizability, you'll need a robust suite of development tools, documentation, and—most important—support from the OS vendor for in-house development. At the very least, developers should expect compilers, debuggers, project management utilities, and visual-programming tools. If you choose a server OS whose vendor caters only to large ISVs, you're unlikely to find a large pool of experienced developers.

Support from third-party vendors is important as well. Tools, programming environments, and complete applications are often available across multiple NOS platforms. By working with familiar tools, developers can leverage their knowledge at all levels throughout the enterprise.

Reliability

Key questions: Does it support RAID or clustering? Is the file system journaled? Can you hot-swap components?

Protected-memory architectures and OS-provided device drivers are hallmarks of reliable OSes like NT, OS/2, OS/400, and Unix. NetWare, on the other hand, runs its applications in a shared memory space, and applications could run in protected mode—ring 0 of the CPU—where they could interfere with the machinations of the OS.

More of the fault tolerance takes place at the hardware level. RAID, whether it's implemented in software or hardware, is common. The advantage of a software implementation such as NT is mainly price. Much of the other fault tolerance—including redundant power supplies, network cards, and cooling fans—depends on the server you buy.

OS/400 and Solaris also have advanced clustering solutions. IBM is working on porting the OS/400 clustering (code-named Phoenix) to OS/2. Microsoft is working on a set of APIs (called Wolfpack) for clustering two NT machines. Digital already has a system to enable NT clusters. By default, clustering is an option to each of these OSes—but often an expensive one, costing thousands of dollars per CPU.

Security

Key questions: Can the administrator enforce password restrictions? Does the OS support access-control lists? On-the-fly encryption? How about Orange Book C2-level security?

continued

as being highly reliable. Server mirroring systems such as Novell's System Fault Tolerance (SFT) and Novell's new IntranetWare servers can self-diagnose and report hardware and software problems, and then engage automatic recovery. However, NetWare relies on running applications in ring 0 for performance, enabling applications (NLMs) access to each other's memory spaces. In theory, anyway, a rampant NLM could crash an entire server.

Security As a file server, NetWare's security is good, with features such as log-on time restrictions, account locking, and the ability to restrict log-on by workstation protocol. But as you layer applications on top of NetWare, you are at the mercy of the developer's security implementation. It is possible, for example, that a backup NLM could give any user access to tapes in your tape drive. Novell is working on a network-level C2 certification for IntranetWare.

IBM OS/2 Warp Server

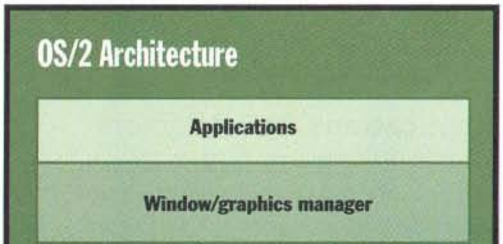
The marriage of OS/2's 32-bit, multitasking, multithreaded core to IBM's LAN Server 4.0 server OS produced Warp Server. The resulting product provides solid applications-server capabilities, along with file and print services, as well as good management tools, remote connectivity, and backup and recovery services.

Applications Although OS/2 Warp Server lacks broad-based applications support, major products and applications categories are represented, especially business applications such as accounting and even CICS. There is, however, no cohesive, consistently implemented integration strategy: Users must integrate third-party solutions.

Platform Support OS/2 runs on any x86 (486 or higher) processor, making it, like NetWare, limited to one architecture. That said, IBM has placed considerable emphasis on integration with other platforms. You'll find clients for DOS; Windows 3.x, NT, and 95; OS/2; AIX; and Mac OS.

Performance As with NetWare, the performance of OS/2 is limited to the fastest x86 processor you can buy. However, Warp Server 4.0 includes SMP that will work with a system with up to 64 CPUs. The SMP feature can provide a boost to existing 16-bit DOS, Windows, and OS/2 applications that aren't SMP-aware. By letting these virtual-mode applications run across multiple processors, rather than on a single processor, the reduction in task-switching overhead should produce an increase in performance.

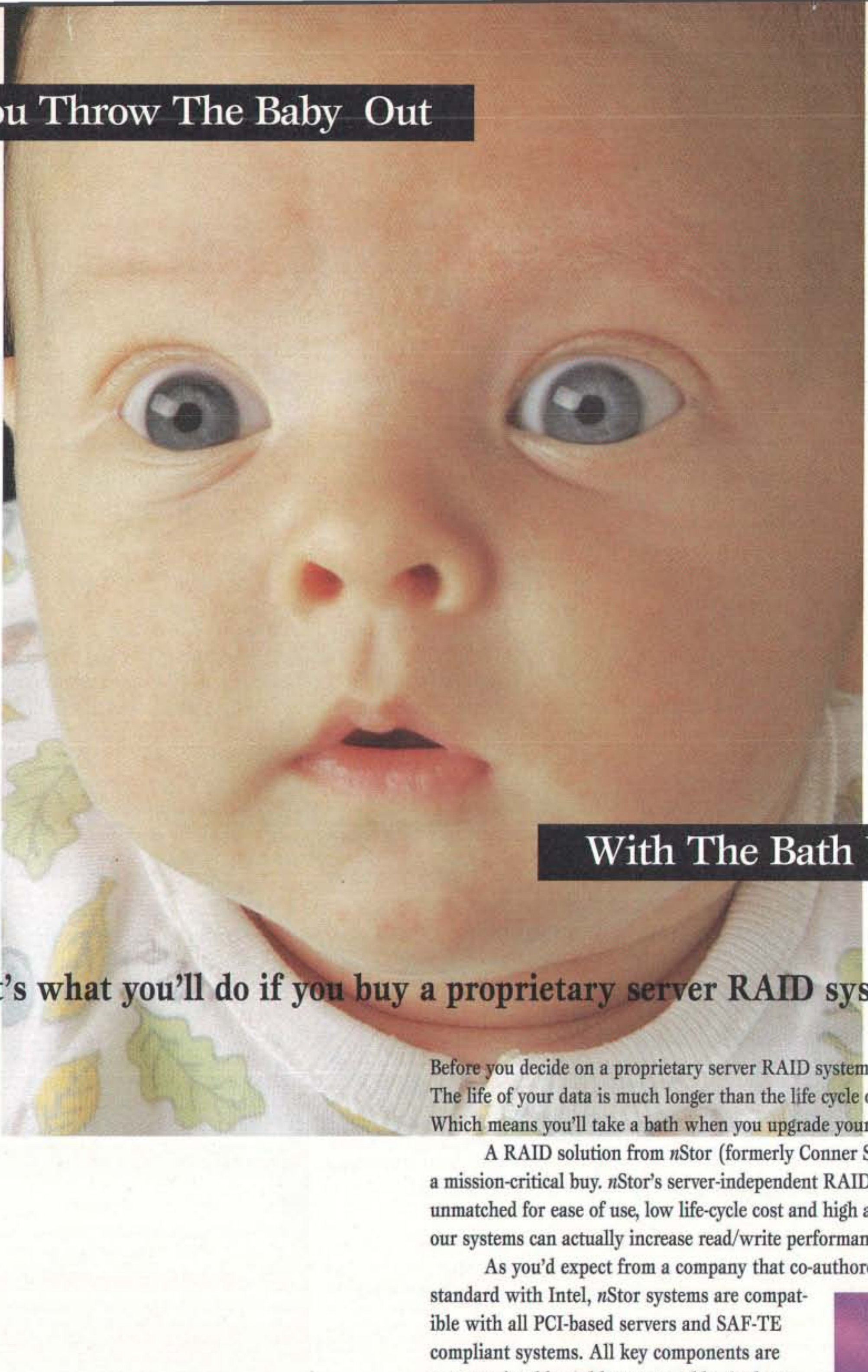
Management OS/2, like NT, supports hardware discovery and supplements that with alerts when hardware is failing. Like NT, however, you need to use multiple applications to perform system administration. The user interface supports drag-and-drop object-based administration, including network-based software distribution and support for SNMP and DMI management systems.



Virtual device drivers offer a direct interface for applications and hardware.

Development IBM provides a selection of visual-programming environments, Software Development Kits (SDKs), and other development tools, including its excellent Visual Age products. That said, the OS includes only token third-party support for native OS/2 environments.

Reliability RAID 0 and 1 (but not 5) are built in to OS/2, as are backup services and utilities for bad drive sector remapping. OS/2 borrows the clustering architecture of IBM's high-end



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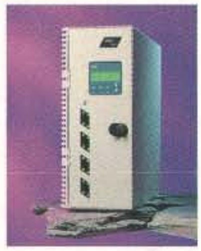

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Security is a tough subject. There are many buzzwords but little uniform interpretation of them. The short of it is that any OS can be compromised if it's not installed and maintained using a strict security policy. You have to enforce alphanumeric passwords, change passwords frequently, and even consider encrypting vital information.

All that said, an OS can make it easier to enforce security. File and directory permissions are a place to start. Each OS implements them a little differently, from the incredibly cryptic (Unix) to the fairly straightforward (NetWare). Again, it's up to a person to make sure they're set up and enforced correctly.

Auditing can let you see who did what when. The logs it generates can become large, but the information can be invaluable when you're trying to trace the last modification of a file. NT comes with a good auditing system that's notably easy to use.

Unix has come under attack for its security. Designed originally to be open, Unix has found itself the object of many attackers' desires. If you choose Unix as your applications-server OS, you should immediately look to your vendor for the latest security patches. You also need to implement a nonsendmail-based mailing system, TCP wrappers, the Washington University FTP daemon, and a regular run of the SATAN security package.

There's much bluster about C2-level security, but that's what most of it is–bluster. There are a couple of reasons for this. First, a C2 rating applies only to the exact version of an OS tested–NT 3.51, for example, has one, but not version 4.0. Also, a Red Book C2 rating (which means the OS is network-secure) means not only exactly the same OS version, but the same hardware.

Sorting It Out

When you put any OS through all these questions, you'll get a good idea of how well it's going to behave as an applications server. NT, Solaris, OS/2, NetWare, and OS/400 are all strong applications-server OSes. And that's as far as these questions can take you. Once you've made a preliminary decision, you have to bring the OSes in-house and try developing an application on your final choices. Yes, it will take time, and it will probably be expensive. But is it really more expensive than making the wrong decision?

Robert L. Hummel is an electrical engineer, programmer, and consultant. You can reach him at rhummel@monad.net.

systems and provides detection of both node and applications failures. In this type of system, if a server or application running on a server fails, that server's work load immediately goes over to an operational server. The system manager can insert the failed server into the cluster after its recovery.

Security OS/2's security includes setting disk-storage limits for individual users, expiring accounts, and forcing password changes.

IBM OS/400

There's no doubt that IBM's AS/400 philosophy represents a highly integrated, powerful, and scalable approach to applications serving across the spectrum from department to enterprise level. However, for LAN managers coming from the workgroup arena, the IBM-only upgrade model of the AS/400 represents a drastic step.

Applications OS/400 has over 25,000 applications available, including the DB2 relational database, decision-support systems, fax systems, and wireless LAN. It comes with the ability to serve its applications up to Web browsers.

Platform Support OS/400 runs only on the proprietary AS/400 hardware, which ranges from $10,000 departmental servers up to enterprise systems. It can run NetWare on an optional plug-in server board, and a similar NT Server solution is being developed. To support PC connectivity, the AS/400 provides middleware for Windows, DOS, OS/2, Unix, and Mac clients. OS/400 supports IPX/SPX, TCP/IP, NetBIOS, and AppleTalk, as well as high-level APIs such as Open Database Connectivity (ODBC), DAL, and MAPI. Its Internet Connection for AS/400 supports HTML drivers, letting a business serve any AS/400 application over the Internet. Internet users can download files or software as well as access the AS/400 database.

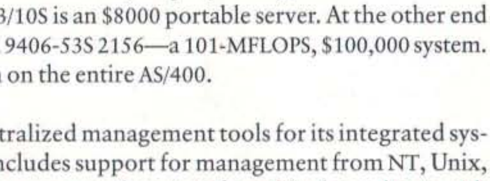
Performance The AS/400's architecture may be proprietary, but it is not limited. The AS/400 Advanced Portable P03/10S is an $8000 portable server. At the other end of the scale is the AS/400 Advanced 9406-53S 2156—a 101-MFLOPS, $100,000 system. The same OS and applications run on the entire AS/400.

Management OS/400 has centralized management tools for its integrated systems. OS/400 version 3 release 7 includes support for management from NT, Unix, and Macintosh clients. You can manage some functions from Windows clients with a drag-and-drop interface. OS/400, like Unix, has a control language that makes it easy for OS/400 to support batch processing.

Development Tools such as IBM VisualGen for OS/400 are high-level development tools. C++, Smalltalk, and other compilers are also available.

Reliability OS/400's fault tolerance is primarily the result of third-party mirroring and replication products. IBM's OptiConnect, an expensive 220-Mbps fiber-optic link, lets you cluster up to 32 processors.

Security OS/400 provides the standard gamut of security features, including password aging, limits to the number of concurrent users, and forced periodic password changes. It also has access-control lists and auditing features.


OS/400 Architecture
Applications
APIs, file system, directory services, POSIX subsystem
Java VM, Security, Process Manager, Database Manager, Thread Manager
Communications
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Networking
Hardware

OS/400 is one of the first IBM OSes with an integrated Java virtual machine.

Suite and Sour

Applications-server suites fall short of their promises but still ease some integration headaches.

By Robert L. Hummel

Like their desktop counterparts, applications suites for servers give you 90 percent of the capabilities you would expect from a custom application for a fraction of the cost. And they integrate well with each other. Suites make sense.

The availability of an applications-server suite may not yet be the pivotal factor in choosing a server OS, but suites are changing the way we evaluate OSes. A major server OS without a suite looks threadbare. However, a comprehensive suite, even if it contains only serviceable applications, can help applications-server end users become satisfied customers.

Many vendors, including Oracle, SCO, and SunSoft, offer applications-server suites. Here's a look at two leading packages, Microsoft's BackOffice and IBM's Software Servers.

Microsoft BackOffice

BackOffice is a set of applications that are designed for—and execute exclusively on—NT Server. The suite includes software for Web services, a database, an e-mail system, and a system management module. In fact, Microsoft considers NT Server itself to be a part of BackOffice.

Choosing BackOffice locks you into using NT Server as your OS. But you can still select Intel or RISC hardware, single-processor or symmetric multiprocessing (SMP) machines, and a range of third-party server and desktop applications. The wide array of supported industry-standard APIs lets you create interfaces between BackOffice and other platforms.

Microsoft is releasing new and upgraded applications servers at a frenetic pace. The current release of BackOffice, version 2.5, contains 10 applications by Microsoft's count. Fully half of these directly address Microsoft's Internet strategy, while the remainder serve more traditional applications.

Internet Information Server (IIS) supports Web, gopher, and FTP publishing on the Internet or on a corporate intranet. Distributed management is enabled, as well as the ISAPI interface for development. System Management Server provides a framework for managing corporate-intranet desktops.

The new Personalization System works with IIS to allow you to implement customized customer interactions. Also new is Merchant Server, which is billed as software for selling products over the Internet.

Designed for collaborative work environments, FrontPage supports authoring, scripting, and Web-site management. The new Proxy Server provides secure Internet access to desktops within an organization. And the Content Replication System offers a way to move bulk data securely across the Web.

Exchange Server establishes the basic infrastructure for BackOffice messaging, collaboration, scheduling, and groupware applications. To support X.400, SMTP, Multipurpose Internet Mail Extensions (MIME), and MAPI, the current version adds POP3, HTTP, Hypertext Markup Language (HTML), NNTP, LDAP, and Secure Sockets Layer (SSL). End-user features, such as rules, filtering, and off-line synchronization, are also enabled. Conference Server, a server for real-time communications, supports shared whiteboard, chat, and IP telephone applications.

Of course, the traditional server applications are not neglected. Microsoft's SQL Server runs as a multiuser client/server relational database. For connection to IBM mainframes and AS/400 systems, Systems Network Architecture (SNA) Server has an Open Database Connectivity (ODBC) driver for access to Distributed Relational Database Architecture (DRDA) databases. It also includes an FTP/AFTP gateway. Also included is the Systems Management Server.

continued

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Legacy Links

Luis Colon is a microsystems specialist at Communications Data Services (CDS), a company in Des Moines, Iowa, that analyzes people's buying habits in order to build marketing models and targeted mailing lists. Because CDS was previously a NetWare shop, Colon says he has evaluated both Microsoft's BackOffice and IBM's Software Servers. In his company's transaction-heavy environment, he says that performance and integration with a legacy database were his key evaluation criteria.

"We run DB2 under MVS, AS/400, and AIX," says Colon. "Although you can get [BackOffice] SQL Server connected to it, the cost of integrating and maintaining an NT server was high enough to eliminate it from consideration."

Colon also says that some of the IBM products were more mature and scaled better than their Microsoft equivalents. He selected IBM's Communications Server for a Systems Network Architecture (SNA) application based on its performance. Colon says his testing showed that improving NT's performance was more dependent on all the pieces being Microsoft products. Communications Server, being somewhat standalone, was a better solution.

Colon views suites as a nice concept, but he's not completely sold. "Having it all in one box is great, but once you get past the installation, the benefits of bundling start to dwindle," he explains. He admits that suites have an advantage as far as licensing, price, and bug fixes are concerned. But he wouldn't use a mediocre application just because it was part of a suite.

Colon believes that neither IBM nor Microsoft has got applications-server suites right yet. If Microsoft is going to make headway in the medium-to-large enterprise, BackOffice has to be available on something besides NT Server, he says. As for IBM, Colon has some advice: "If you're going to do integration, you should work on integrating the user interface to cut training costs." Each, it seems, could learn something from the other.

IBM Software Servers

In the strictest sense of the word, IBM's Software Servers are not a suite. Although they're designed to work together, they are individual members of a modular family of seven client/server application-enabling products. Each server includes installation software for various clients as well as software development kits for developing or tailoring applications for each server. Because they're installed separately, you can select the particular applications you need to fit a specific server without loading unnecessary software. Later, if your needs change, you can add other Software Servers.

IBM chose this modular approach in an attempt to appeal to large and small network installations alike. For big information technology (IT) organizations that have large legacy systems, an applications server might function as an organization's back-end tool on which to build its custom application.

In-house integration of dissimilar tools is taken for granted, so the number of related products in the box is unimportant. Rather than being forced into purchasing a closed suite in which the components work only with each other, many large IT groups prefer to have new products that support open interface standards. Conversely, small companies might think that integration is key, and to them, an applications-server suite doesn't mean tools—it means end-user applications.

Lotus Notes, with its messaging and groupware capabilities, is a part of this server collection, as is Database Server, a relational database management system (RDBMS) that enables you to create, update, and control databases using SQL. Internet Connection Server acts as a repository for HTML documents and gives access to existing applications on CICS, DB2, and Notes. It also provides for secure access and acts as a proxy server.

Communications Server enables applications to communicate with other workstations and with host computer systems. Transaction Server is based on CICS. It enables three-tier, on-line transaction processing (OLTP) applications. Directory & Security Server is based on the Open Software Foundation's Distributed Computing Environment (DCE) standard. Finally, the Systems Management Server addresses network management, disaster recovery, security, and the ability to respond to change.

All seven products are available for the AIX and OS/2 server platforms. The Notes, Database, and Internet Connection servers are available for Windows NT as well. Communications Server for NT is now in beta. The Transaction, Directory & Security, and Systems Management servers are scheduled for early-1997 delivery.

Robert L. Hummel (Sullivan, NH) is an electrical engineer, programmer, and consultant. You can reach him at **rhummel@monad.net.**

Help for Integration Woes

For Whit Gregg, server suites may not be perfect, but they are strong medicine for integration headaches. "Having gone through a decade of open systems, where we were integrating everything, preintegration of products represents a real benefit," he explains.

Gregg is director of MIS at Sanford C. Bernstein & Co. (New York, NY), an investment research and management firm. Part of the network he oversees hosts a sophisticated document system that generates unique customer reports via 60 Windows NT–based servers running throughout the firm. Microsoft's BackOffice is a key component in that system.

As reports are requested, they're assembled with customer-specific information, opinions, and market data. Gregg deploys pieces of BackOffice as required, and he's integrating more into the system. The data that feeds into the reports currently comes from a Sybase database, but it's being moved to SQL Server.

His company chose BackOffice partly because of Microsoft's size. Although his firm has occasionally dropped products and changed directions, Gregg isn't worried about it possibly happening again. "If I end up on the wrong side of a technology, I want to be with the majority in making that same mistake," he reasons. "The same logic that had us buying IBM in the 1970s has us buying Microsoft in the 1990s," he adds.

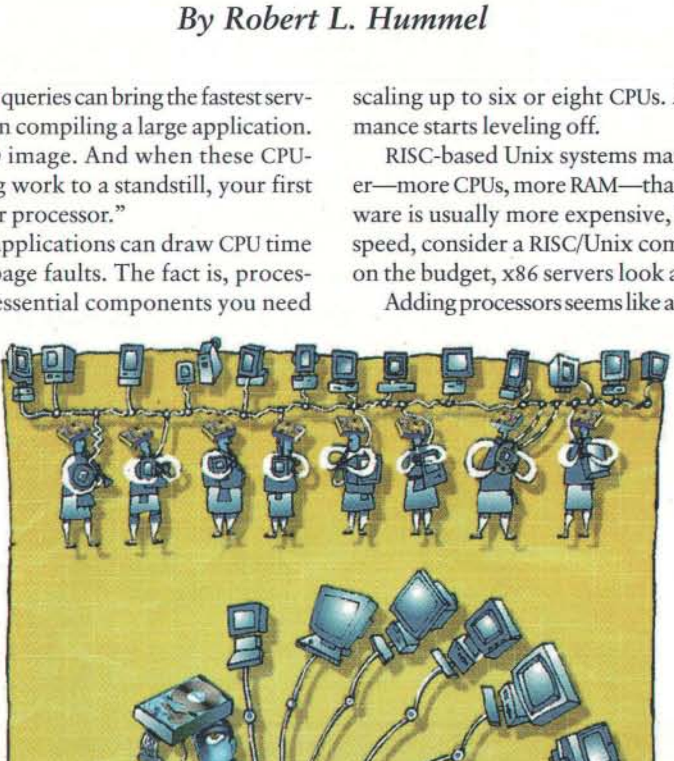
Power to the Server

Getting the best performance from your applications server depends on three key components.

By Robert L. Hummel

A couple complex SQL queries can bring the fastest server to its knees. So can compiling a large application. Or rendering a 3-D image. And when these CPU-intensive tasks bring work to a standstill, your first reaction may be, "I need a faster processor."

However, even I/O-bound applications can draw CPU time by processing interrupts and page faults. The fact is, processor speed is only one of three essential components you need to consider when you're designing your server. In addition to considering how CPU-intensive your application is, you need to ask: How I/O intensive is it? Then ask: How reliable do I need the system to be?



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RISC chips like Digital Equipment's Alpha and IBM's R10000 have been holding the high-performance end of the applications server market. In Unix shops, x86-based systems have generally been consigned to file, print, and light-duty applications service. But today, the widespread availability of symmetric multiprocessing (SMP) systems that are built around Intel's Pentium Pro chip is changing how x86 systems are deployed for running centralized applications.

SMP is hardly a new technology. What is new are low-cost SMP systems from companies like Compaq, Dell, and ALR that marry Windows NT with the top members of Intel's CPU family.

To see a performance increase, however, both the server OS and the application must support SMP. Even then, performance does not typically scale linearly with the number of processors added (see the figure "Scalability by Number of CPUs"). Depending on the application and the OS, a two-CPU x86 server will improve from about 70 to 80 percent over a single-CPU system. Upgrading from two to four CPUs produces about the same enhancement. RISC-based Unix systems often offer more linear scaling up to six or eight CPUs. After that the system's performance starts leveling off.

RISC-based Unix systems may deliver more raw horsepower—more CPUs, more RAM—than x86-based systems. The hardware is usually more expensive, however. If you need outright speed, consider a RISC/Unix combo. If you need to keep an eye on the budget, x86 servers look a lot better.

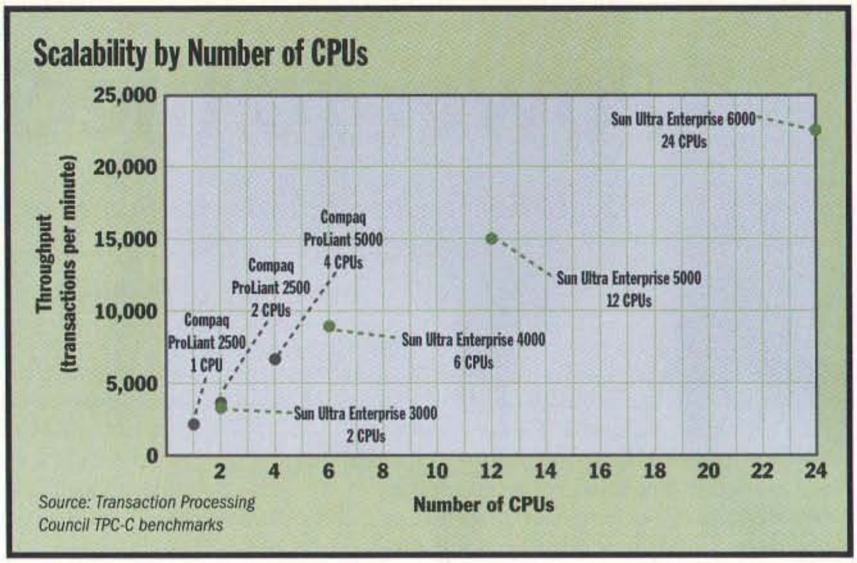
Adding processors seems like an easy way to gain performance. But as with most fixes, it shifts the spotlight to other bottlenecks. Additional processors increase performance only until the number of processors contending for memory access and bus space creates bottlenecks. Beyond four processors, for example, the memory throughput of a typical Intel-based server becomes the limiting factor for scalability.

The most common configuration for SMP applications servers employs a separate L2 cache for each processor. This distinguishes them from multiple-CPU desktop systems that use a shared cache design. The Pentium Pro's internal nonblocking L2 cache makes it significantly faster than an equivalent external-cache system, such as the Pentium. The Pentium Pro with the 512-KB cache performs better in benchmark tests than the 256-KB cache version.

At a primitive level, scalability also means the ability to add components to a server system, and that means counting buses and open slots. A Silicon Graphics Challenge S, for example, has three SCSI buses, but two of them are differential SCSI—which adds significantly to the cost of the peripherals you'll buy.

For multiprocessor x86 applications servers, the PCI bus is now the high-performance standard and has replaced the EISA bus. But electrical limitations keep the number of slots that a PCI bus can support to four or fewer. To increase the number of PCI adapter slots, system designers are adding PCI bridges—circuits that connect distinct buses. Using a bridge, a second PCI bus can be added to the system. How the bridge is connected can have a significant impact on the performance of the server. For example, in a cascade or hierarchical configuration, the second PCI bus is connected (via a PCI-to-PCI bridge) to the first PCI bus. In addition to its own load, the first PCI bus must also transfer the data load for the second bus. The effect is to share the 132-MBps system bandwidth of the first bus between both buses. The PCI bus may be bridged to an EISA bus in a similar fashion, further limiting throughput.

Peer bus design uses an alternative approach, bridging the first and second PCI buses individually to the system bus. Because data can flow independently to either bus, total system I/O can go as high as 264 MBps. This is the better alternative for high-performance servers.

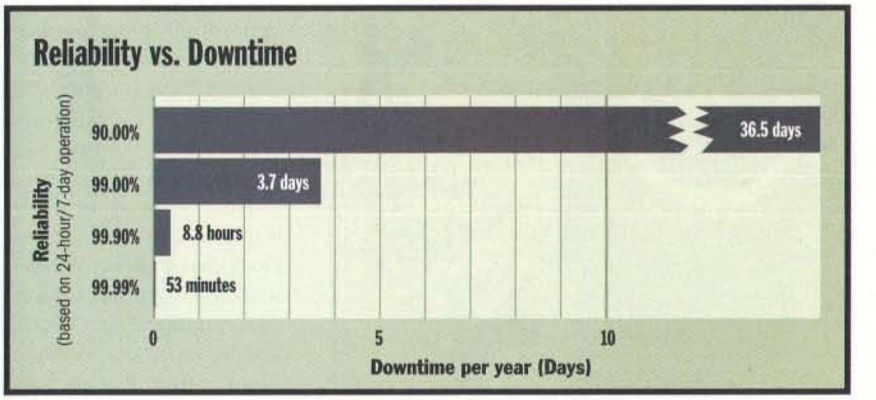


Source: Transaction Processing Council TPC-C benchmarks

A Sun SPARC system offers more linear scaling than a Compaq ProLiant for small numbers of CPUs.

Reliability and Availability

Downtime. It's the bane of every IT manager's existence. Fault-tolerant solutions generally fall into two categories depending on their level of protection. Server reliability solutions focus on making any single server as fault-tolerant as possible, using approaches such as redundant power supplies and RAID technology.



90 percent reliability means you're down four days a month; 99.99 percent reliability means you're down four minutes a month.

High-availability solutions address reliability at the server level. Failover, one aspect of clustering, ensures that if the primary server is lost, a standby server takes over. After the problem server is repaired, the system should provide a simple way to bring it back into the network.

Fault-tolerant solutions should satisfy several criteria. They must work in real time to minimize the period when services are not delivered to users. Better systems such as IBM's AS/400 will make the switch transparently, allowing users to continue work without losing network connections. Any system that duplicates data between the primary and the standby server should be transaction-based. Any data committed to disk at the time of the crash should be available on the standby server. Failover must be automatic and work without requiring manual monitoring or intervention. It should not require that the servers be identical.

You can set up your standby server to act as a passive backup machine only. It would monitor your primary server and receive data continuously but perform no other functions on your network. A more cost-effective approach would be to cast the backup server in the role of utility server, where it could run printer, database, or communications services while in its standby mode. In the event of a failure, the standby server would automatically take over the functions of the primary server in addition to the utility services.

The final measure of any system is vendor support. Keeping your server operating may be crucial. But is it as important to your supplier? Be sure you can get service and support at the level you require around the clock or around the world.

Which system provides the best performance and resilience? Right now, the scales tip toward RISC/Unix systems and the AS/400 with their better-developed clustering and SMP technologies. An x86-based SMP system running Windows NT provides solid performance at a relatively reasonable price, but there are few SMP systems that have more than four CPUs, and the third-party clustering technology is still an unknown.

Before you purchase your hardware, you should buy or rent a test system and assess the performance of your application running on it—how much RAM it needs, how well it scales across multiple CPUs, and so on. Then you'll be able to make an informed decision about how to balance price and performance. **B**

Robert L. Hummel is an electrical engineer, programmer, and consultant. You can reach him at **rhummel@monad.net**.

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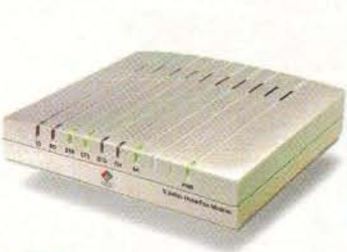

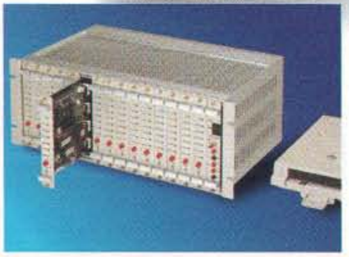

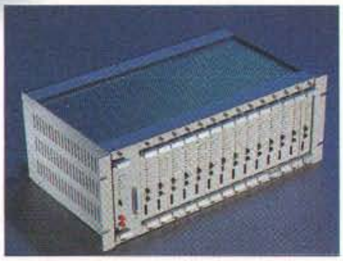

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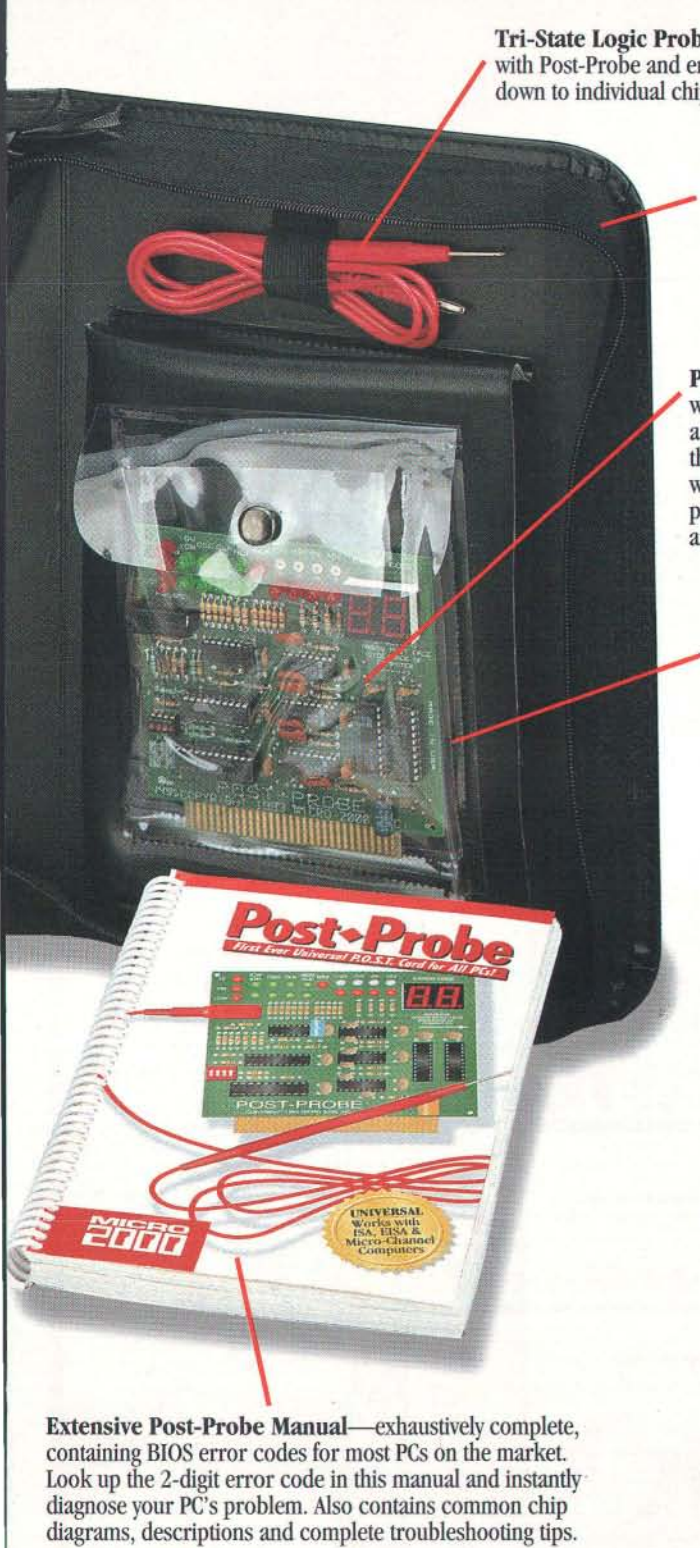
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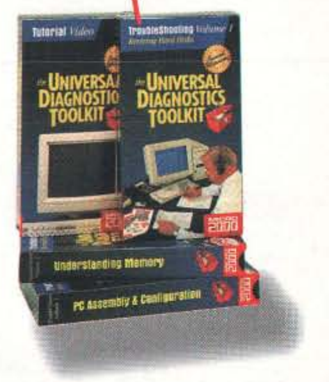
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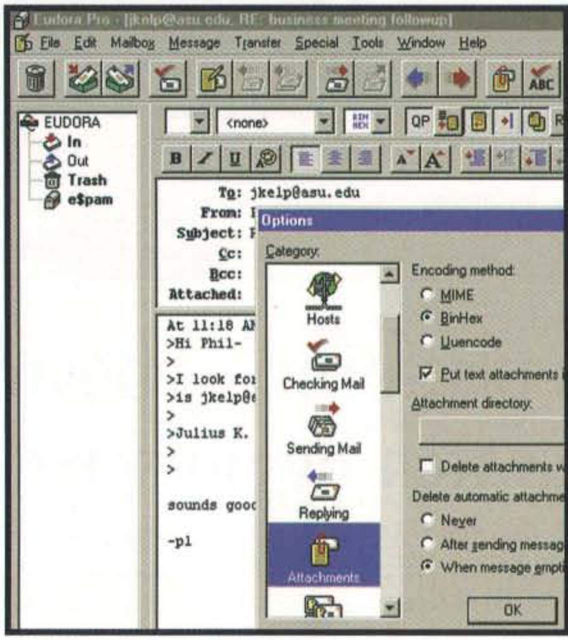
The Web's most popular e-mail client has a new, 32-bit Windows client and much-enhanced filtering options. *By Steven J. Vaughan-Nichols*

Eudorable Web Mail

Qualcomm's latest Internet e-mail client, Eudora Pro 3.0 for Windows, delivers a new, 32-bit mail client for Windows 95 or NT and a 16-bit version for Windows 3.1. Plus, it makes the Wintel offerings comparable to the Macintosh upgrade released last summer. Eudora has long been the source for robust, solid e-mail clients, but this release adds extra features and polish. If you don't agree it's worth $89 ($69 if you buy direct on the Web), you can download a "light" version for nothing.

This upgrade does a good job of making POP/SMTP mail more manageable, adding support for Microsoft Exchange MAPI messages as well as the ability to retrieve e-mail from multiple POP accounts. Qualcomm has enhanced Eudora's mail-handling filters for greater flexibility in sorting incoming messages to different mailboxes, automatically responding to messages or senders, even dumping unwanted mail directly in the trash can. The Eudora address book has been enhanced, adding fields for fax and phone numbers. Qualcomm has also improved the program's handling of mail list groups.



```
        To: jkelp@asu.edu
      From: I
   Subject: F
        Cc:
       Bcc:
  Attached:

At 11:18 AI
>Hi Phil-
>
>I look fo
>is jkelp@
>
>Julius K.
>
>

sounds goo

-pl
```

Encoding method:
○ MIME
● BinHex
○ Uuencode
☑ Put text attachments i
Attachment directory:
☐ Delete attachments w
Delete automatic attachme
○ Never
○ After sending messag
● When message empt

Choosing the default file-attachment protocol is only one of many Eudora Pro options.

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Qualcomm Inc.,
Eudora Division
San Diego, CA

(800) 238-3672
(619) 587-1121

eudora-rep@eudora.com
http://www.eudora.com

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The mail filtering system is a godsend to anyone who spends much of the day trying to swim to the surface of the e-mail flood. Choose the Filter option from the Tools menu and you can set rules for scanning incoming mail with up to two conditions in any part of a message's header or body. You can select five different actions for each message, including tossing the message into the trash, sorting a mail list item into its own folder, or using a form letter to respond automatically to requests. For example, you can create one filter that searches for the word "help" in message bodies, then autorespond with a message that says help is on the way. As e-mail rule systems go, it's impressive.

RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★★
PERFORMANCE	★★★★

New in 3.0 are templates called stationery files, useful for sending the same message over and over. Sending price lists, directions, or any canned response is easy with these templates. Also new is the Extended Messaging Service Application Programming Interface (EMSAPI), which can support e-mail client plug-in modules that may eventually do things like encrypt or decrypt plain text messages, generate digital signatures for your own messages or verify digitally signed messages, run compression routines, or analyze message content. Unfortunately, though EMSAPI sounds impressive, only Qualcomm supports this proprietary standard at the moment, and only with very simple text-formatting plug-ins.

That Eudora is a robust, bug-free program should not be surprising considering Qualcomm's claimed 10 million users; if that number is accurate, Eudora is the most popular Internet e-mail client on the planet. I found the freeware version to have all the features I need. If you want a 32-bit mail application with powerful filtering functions, a configurable toolbar, the ability to handle e-mail from more than one POP account, an enhanced address book, and more, then Eudora Pro 3.0 is an excellent choice. B

Steven J. Vaughan-Nichols is a writer who frequently covers Internet-related issues. You can reach him at **sjvn@vna1.com.**

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

Comparison

CD-ROM Drives

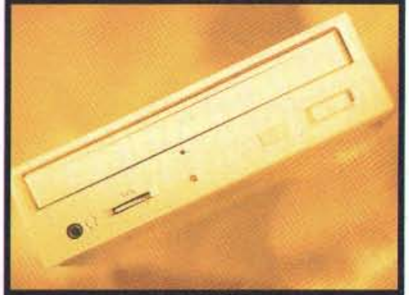
Want the fastest drive on the block? Check out one of these screamers. ***By Jacqueline Emigh***

All 12X CD-ROM Drives Are Not Equal

PIONEER DR-444

RATINGS	
TECHNOLOGY	★ ★ ★ ★
IMPLEMENTATION	★ ★ ★ ★
PERFORMANCE	★ ★ ★ ★

MITSUMI FX-120T



RATINGS	
TECHNOLOGY	★ ★ ★ ★
IMPLEMENTATION	★ ★ ★ ★
PERFORMANCE	★ ★ ★ ★

PLEXTOR 12PLEX PX-12CSI

RATINGS	
TECHNOLOGY	★ ★ ★ ★
IMPLEMENTATION	★ ★ ★ ★
PERFORMANCE	★ ★ ★ ★

TOSHIBA XM-5701B

RATINGS	
TECHNOLOGY	★ ★ ★ ★
IMPLEMENTATION	★ ★ ★ ★
PERFORMANCE	★ ★ ★ ★

In the beginning, the CD-ROM ran at 1X speed, which begat 2X, then 4X, and on and on. The fastest drives you can buy right now are 12X screamers, which satisfy better than ever the high throughput speeds of multimedia and networked CD-ROM applications. Just a couple of years ago, the best (4X) drives transferred data at 600 KBps. The new 12X drives—from such CD-ROM kingpins as Mitsumi, Pioneer, Plextor, and Toshiba—can transfer data as fast as 1.8 MBps. However, if you've seen just one of these new 12X drives, you haven't necessarily seen them all.

Going Around in Circles

Until quite recently, all CD-ROM drives were based on a technology called constant linear velocity (CLV). Like the selections on a music cassette, the files on a CD-ROM drive are laid down one after another, ultimately forming a spiral. And, like recorded tape, CLV keeps the recorded data moving past the reading head at a constant speed, thus easily maintaining a fixed data-transfer rate.

To make this happen, though, the drive must spin the disc faster as it reads tracks that are located closer to the center, because the inner tracks are shorter and contain less data than the outer tracks—much as a slice of pie is narrower at the center than at the outer crust. (BYTE readers with long memories will remember floppy disk drives that also used CLV.)

While CLV simplifies data handling, it complicates the physical operation of a drive. As drive speeds push higher, there comes a point where the ever-increasing rotational speed causes its own problems, such as vibration. While it's not a factor at lower rotation rates, vibration can be problematic at higher speeds with unbalanced CDs and some OEM casings; in some situations, the disc rattles in the drive and can cause undue wear or even drive breakage.

Most CD-ROM drive vendors are opting for a solution that combines CLV with another approach, constant angular velocity (CAV), which uses a steady spin speed analogous to that of a phonograph record. CAV is helpful in achieving high performance at lower spin rates and for minimizing vibration.

Previously adopted by vendors of laserdisc players from hard drive technology, CAV relies on a variable data transfer rate, as opposed to the fixed rate of CLV. Data access can be faster, too, because it isn't necessary for the motor to speed up or slow down to change its rotational rate.

Comparing access times isn't easy, though, because different companies use different measurements. Access times are rated in two different ways: by how long it takes the read head to move a speci-

PHOTOGRAPHS: BRIAN WILDER © 1997

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

fied distance across the disc, and by how long it takes the head to actually read data from its location on the disc. The second type of rating, called *access time with latency*, is variously referred to as "random seek time" or "average random access time" by vendors.

Is access time important? The answer depends on your particular application. Random seek time can be a significant factor in applications such as computer games, where the head is moving constantly about the disc. Access time is not important, though, if all you're doing is copying a program or an OS to the hard drive. In this type of application, the head reads data in a steady stream.

Interface Matters

The type of interface used is another differentiator between drives. Despite their advantages for cross-platform and multi-peripheral connectivity, SCSI implementations can be more complicated to install (especially on Wintel machines) than drives with IDE interfaces. To ease this process, vendors of SCSI drives are adopting a technology that is known as SCSI Configuration AutoMagically (SCAM).

Another trait of drives with SCSI connectors: The larger the memory buffer, the better the throughput. Among the contemporary crop of high-speed 12X drives, buffers range from 128 KB up to 512 KB. Implementation, however, can be even more important to drive performance than the type of technology used. Depending on how it's implemented, a 128-KB buffer can be more efficient than a 256-KB buffer, for example.

12X CD-ROM Features

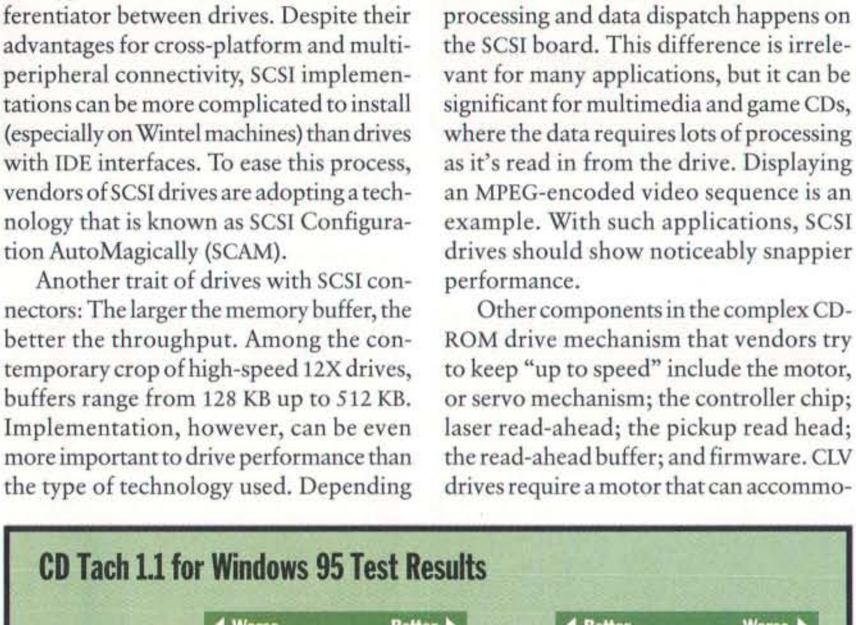
	SCSI-2	ATAPI	Pure CLV	CLV/ CAV	Caddy	Tray	SCAM	Buffer size (KB)	Typical access time (ms)
Toshiba	✓	✓		✓	✓	✓	✓	256	125
Pioneer	✓	✓		✓		✓		128	N/A
Mitsumi		✓	✓			✓	N/A	256	130
Plextor	✓	✓	✓		✓	✓	✓	512	110

✓=yes; N/A=not applicable.

One important difference between the two types of interfaces (as far as CD-ROM drives are concerned) is that SCSI drives require considerably fewer CPU cycles than IDE drives do, because much of the address processing and data dispatch happens on the SCSI board. This difference is irrelevant for many applications, but it can be significant for multimedia and game CDs, where the data requires lots of processing as it's read in from the drive. Displaying an MPEG-encoded video sequence is an example. With such applications, SCSI drives should show noticeably snappier performance.

Other components in the complex CD-ROM drive mechanism that vendors try to keep "up to speed" include the motor, or servo mechanism; the controller chip; laser read-ahead; the pickup read head; the read-ahead buffer; and firmware. CLV drives require a motor that can accommodate variable speeds—a different type than what's used in CAV units.

CD Tach 1.1 for Windows 95 Test Results



Multimedia and Application indexes are weighted indexes based on throughput, CPU utilization, and random-access time. Tests were run with Windows 95 supplementary CD-ROM caching and read-ahead set at maximum levels for best performance.

Random Access was tested with minimal Windows 95 caching and read-ahead to obtain the best times.

CD Tach 1.1 for Windows 95 is a product of TestaCD Labs, (408) 944-9860.

All tests were run on a 200-MHz Gateway 2000 P5-200 Pentium system with 16 MB of RAM.

Toshiba XM-5701B

ADVANTAGES:
+ First SCSI-2 12X drive
+ SCAM for easy setup

DISADVANTAGE:
- Middling application performance

Toshiba's first two entries in the 12X arena, the XM-5701B SCSI and the XM-5702B ATAPI (enhanced IDE) drives, typify the rising industry trend toward combining CLV and CAV. Under Toshiba's Partial Constant Angular Velocity (PCAV) model for its 12X drives, CAV is used for reading the inner portion of the disc, and CLV is used for the outer tracks.

Like other drives implementing CLV, the Toshiba internal drives attain a sustained data transfer rate up to 1.8 MBps on the outer tracks. Average random-access time is 125 milliseconds. Both drives use a variable-speed playback system designed to reduce random-access times by allowing the drive to read data upon seek completion, before the disc reaches standard rotational speeds.

Toshiba's XM-5701B is the first 12X drive to be outfitted with a SCSI-2 connector. For easier SCSI connection to a PC or a Mac, the XM-5701B comes with SCAM Level 2 software.

The Toshiba drives can be mounted either horizontally or vertically within a PC or a Mac. Both 1.98-pound internal drives come standard with a tray-loading disc mechanism; an emergency eject button; and a "media-removal prevention" feature for making sure the disc does not eject during read operations. The XM-5701B SCSI unit is priced at $195; the XM-5702B ATAPI costs $165. Toshiba is also planning to offer an external SCSI-2 model, the TXM-5701.

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The editors of BYTE Magazine gave the Best of Show award at Computex Taipei....Spot Technologies ScanTak-2c, an inexpensive color flatbed scanner with a host of nice useful software applications...

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...The flatbed scanner FotoTak occupies a very small place on the writing desk and is a good scanner for pictures and logos scanning...

GER **PC MAGAZINE** February, 1996 PC Magazin

...A user with experience takes only up to 15 minutes to install the interface card and installing the software. The operation is very easy. Strengths: simple installation, simple usage, good price and performance...

BLG **CPN MAGAZINE** April, 1996 CPN

..ScanTak-2c flatbed color scanner produces true-to-nature colours, multi-windows scanning, console screen preview, intelligent user interface..."

GBR **PC MAGAZINE** October, 1996 PC MAGAZINE

...Highly recommended Spot's ScanTak-2c...

GBR **Computer Life** October, 1996 ComputerLife

...ScanTak-2c is ideal for OCR, scanning for Web pages and colour positionals for DTP. It's a neat TWAIN-compatible, plug-and-play device. Business card software, a document management desktop, morphing, editing and OCR tools are all provided - all of it is perfectly functional...

HKG **MODERN ELECTRONICS** June, 1996 現代電子

...There seems to be no procedent for this super-value offer, ScanTak-2c. Spot Technology also has another remarkable new product. The compact FotoTak-6 flatbed colour scanner for photographs and pictures...

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CeBIT HIGHLIGHT 1996 Grand Prize
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ComputerLife 4 Balls Rating October, 1996
" very good" rating
October, 1996

ComputerLife 5 Balls Rating November 1996
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TECH FOCUS DRIVE SPEEDS

CD Algebra: 12X = 10X = 8X?

For most people, CD performance is measured in X's. What's an X, you ask, and why? In CD-ROMese, 1X refers to the original CD-ROM drives, which could transfer data at 150 KBps. Then we got double-speed drives, abbreviated as 2X, which spun twice as fast as the 1X devices. As drive rotational and data transfer speeds increased, the X nomenclature stuck, so we now have 12X drives, and 16X units will be out soon. Theoretically, this X rating means that a 12X drive spins 12 times as fast as 1X units and transfers data at 1.8 MBps.

The 12X drives are capable of operating at up to 12X rotational rates, but strictly speaking, there's no such thing as a "pure" 12X drive. In the real world, 12X CD-ROM drives attain these speeds only under optimum conditions. Even a CLV drive will fall back from 12X to 8X—and subsequently to 4X and 1X—if disc imperfections get in the way of read performance.

One advantage of CAV is that fallback to slower speeds tends to occur in much smaller increments. This keeps the data transfer rate close to its 1.8-MBps maximum.

Acknowledging this situation, some vendors are now beginning to move beyond simple-minded terminology. They are now describing spin rates in terms of ranges or averages.

Pioneer DR-444

ADVANTAGES:

- + Vibration sensor to control mode
- + Highest throughput, lowest access time

DISADVANTAGE:

- − No caddy model available

Pioneer was the first company to combine CLV and CAV technologies in its earlier 8X drive. With its new DR-444 and DR-466 SCSI 12X internal drives, the company adds two new twists: a vibration sensor attached to the on-board embedded controller, and a new CLV/CAV switching mode, controlled by the drive's firmware.

When the vibration sensor detects a vibration level of over 4 g's, the drive switches from CLV to CLV/CAV mode, slowing the disc's rotational speed. The drive then gradually speeds up until it reaches the CLV threshold, where it maintains a constant rotational rate unless it encounters high vibration again. OEMs can set the vibration level to 2.2 g's. Also new is a redesigned VLSI chip set, intended to provide true CLV throughput in CLV mode.

Both drives transfer data at 1800 KBps under CLV, with a stated average random-seek time of 80 ms in "combination mode," and a data-access time of 100 ms. Pricing was not available at press time.

PRODUCT INFORMATION

DR-444
Price not established
Pioneer New Media Technologies, Inc.
Long Beach, CA
(800) 444-6784
(310) 952-2111
fax: (310) 952-2990
http://www.pioneerusa.com
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FX-120T
$249
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fax: (214) 550-7424
http://www.mitsumi.com
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$399 for caddy version; $349 for internal tray version
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fax: (408) 986-1010
http://www.plextor.com
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Plextor 12PleX

ADVANTAGES:

- + Available in tray and caddy versions
- + 512-KB buffer

DISADVANTAGE:

- − Expensive

With its new 12PleX drive, Plextor is sticking with traditional end-to-end CLV. The theory is that it's better to offer a sustained data transfer rate for high-throughput networked and video streaming applications—since most CD applications don't contain enough data to fill the disc anyway and, consequently, to benefit from combined CLV/CAV technology.

Available in both internal and external tray-loading and caddy-loading versions, Plextor's 12X CD-ROM drive also includes a feature called automatic audio alignment, for no-skip audio playback.

Despite its CLV design, the 12PleX provides a fast random-access time of 105 ms. Software utilities bundled with the drive let you adjust the default 2-minute spin-down time for flexible data-access times.

The utilities also include audio controls plus an audio-capture tool, which allows you to quickly save standard audio CDs to the hard disk as WAV files. For more rapid audio/video playback, Plextor's 12PleX drive uses a SCAM-compliant fast SCSI connector, plus a roomy 512-KB disc buffer.

Priced at $399 for the caddy version and $349 for the new internal tray version, the 12PleX kits include a bus-mastering SCSI host adapter.

Mitsumi FX-120T

ADVANTAGES:

- + Relatively inexpensive
- + Bundled with two CDs

DISADVANTAGE:

- − Slowest performer

Mitsumi's new FX-120 Series of 12X CD-ROMs also use CLV technology from end to end. But that will change when its next drive generation arrives later this year, with rated speeds of 16X.

The Mitsumi 12X internal ATAPI IDE drive operates at a sustained data transfer rate of 1800 KBps, with a reported data-access time of 130 ms. The internal memory buffer has a capacity of 256 KB.

The FX-120 Series also features a patented tray design that holds the CD while permitting the drive to operate either horizontally or vertically. The $249 drive is bundled with two CD-ROM discs from Microsoft: the Internet Explorer Web browser and Games for Windows 95.

For its 16X drives, Mitsumi plans to use a combined CLV/CAV approach. Much like Toshiba's 12X design, Mitsumi's 16X strategy calls for CAV on the inner tracks and CLV on the outer tracks.

Our BYTE Best pick is the Pioneer DR-444. It has the highest throughput and lowest random-access time, giving it the best application score on the CD Tach test. Plus, we were impressed with its switched solution to the CLV vibration problem, and we expect its high CPU utilization to drop in the SCSI version. **B**

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*Jacqueline Emigh (***jemigh@ix.netcom.com***) is a freelance writer based in Boston.*

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26 ☐ Desktops (Micro's/Workstations)
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28 ☐ Application Software Products
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30 ☐ Telecommunications Services

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34 ☐	500-999	40 ☐
35 ☐	100-499	41 ☐
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45 ☐ Department wide
46 ☐ Individual

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Review

Web Update Software

Marimba's Castanet applies a new broadcasting paradigm to Web-based publishing and software distribution. By Pete Loshin

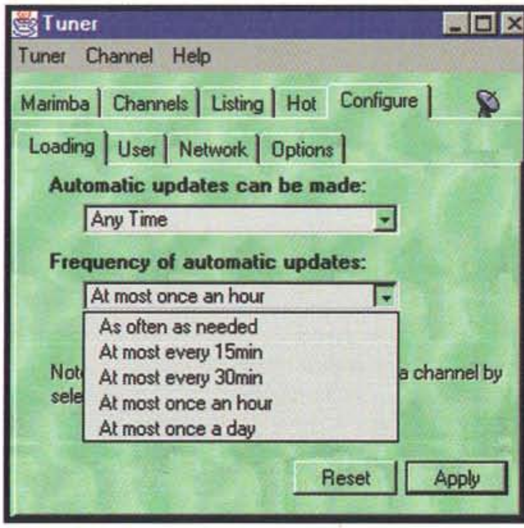
Tune In, Turn On the Web

Change is the only constant in the world of the Internet. Keeping up with it is tedious and inconvenient; whether you're after news or the latest browser release, downloading the necessary files and pages repeatedly can get tiresome. Marimba, a start-up company run by former members of Sun's Java development team, may have the least-effort answer for keeping current with Web updates. A unique architecture embodied in Marimba's new Castanet Software Distribution System combines server "push" and browser "pull" to get around the Web's growing bandwidth problems. The result is fast, efficient distribution of Web pages and Java programs.

Castanet borrows somewhat from the cable TV model. With TV, you need a cable box that's fed by a transmitter, you sign up to receive specific channels of programming, and you tune in whenever you want. With Castanet, instead of a cable box you use the free Castanet tuner client. On the server side, a Castanet transmitter delivers the information (software for a repeater and proxy server are expected to be available by the time this review sees print). The channels deliver Java applets, applications, or Web pages, and you receive only those you've subscribed to.

RATINGS	
TECHNOLOGY	★★★★★
IMPLEMENTATION	★★★★
PERFORMANCE	★★★★★

Mac versions of all products will eventually join those for Windows 95 and NT and Solaris.



Automatic updates can be made: Any Time

Frequency of automatic updates: At most once an hour

Castanet and Bongo Tuner: free
Transmitter: $995 for 100 users per hour per channel; $15,000 for unlimited license.
Bongo: $495 (Windows 95 or NT 4.0, or Solaris 2.4 or higher).

Marimba, Inc.
Palo Alto, CA

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Users configure the Castanet tuner to update Castanet channels as often (or as rarely) as desired.

Using beta versions of the Castanet transmitter and Bongo, Marimba's channel-building tool, I brought up a simple channel in less than an hour. The Castanet tuner is about as easy to use as an average stereo system. Download and install it, fill out a dialog box with a bit of network and personal information, and you can "subscribe" to channels—that is, download software and/or data. Channels are downloaded through Web pages like Marimba's (http://www.marimba.com/channels/) or by connecting directly to a Castanet transmitter through the tuner control panel.

Most controls are clearly marked on the front of the box. You control frequency and schedule channel updates by clicking on the Configure Loading tabs of the tuner control panel. You can easily create a desktop icon for a Castanet channel by selecting the channel and then choosing Create Shortcut from the Channel pull-down menu.

Castanet adds a Channels option to the Windows taskbar through which you can start all subscribed channels whether or not you're connected to the Internet or an intranet. The default is for a channels option to appear at the top of the Windows taskbar, with each transmitter listed separately and all channels appearing as suboptions under their respective transmitters. If you don't care for that arrangement, you can move the icons anywhere on the taskbar.

Turning On, Tuning In

Underneath the hood, the cable-TV analogy is less appropriate. The tuner regularly polls all transmitters that carry channels to which it's subscribed, and each transmitter responds by sending the latest versions of those channels if they differ from the tuner's current version. Update frequency varies, depending on the end-user configuration as well as on the channel itself.

Castanet uses Application Distribution Protocol (ADP), a protocol for mirroring code and data over network connections, to improve performance and optimize bandwidth. Where possible, updates are done incrementally to save on bandwidth. In all cases, users get the most recent update available.

continued

The transmitter is as easy to administer as the tuner. It involves setting a root directory, host name and port number, and password and trusted hosts for administration. Advanced settings include the number of concurrent processes and threads, as well as the size of the memory cache for each process. Once the transmitter is configured and launched, you can add, remove, or modify channels with the putback program, even while the transmitter is running. You don't need to bring the system down for updates.

Putback is fairly easy to use once you've figured out the steps. This is where you can enter a channel's description, author, and administrator. You can also set the update frequency for specific channels. For example, if the channel is a stock-ticker applet, you can set it to look for updates frequently; if it's a daily crossword puzzle, there's no need to update it more than once a day. You can also set the update frequency for inactive channels—that is, how often the channel should be updated even when it's not being used.

Banging on the (Bongo) Drums

Bongo is a visual tool for authoring Java applets and for creating GUIs, called presentations, which are Castanet's basic building blocks for turning data and applets into channels. Bongo includes a full toolbox of GUI widgets and a framework for integrating them.

Bongo was easy enough even for this nonprogrammer. It's evocative of HyperCard in its extensive use of containers and scripting. You edit presentations in two separate windows: a control panel for opening files and editing properties and scripts, and another window for visually editing or browsing the presentation itself.

Adding a GUI component is as simple as choosing one from the editing window's New pull-down menu. You can resize it or drag it around the window with your mouse in the browsing/editing window. You can also edit a widget script and modify appearance properties, such as labels, patterns, and text alignment, in the other window. Marimba adds plenty of sample code and a simple tutorial to the generous helping of GUI widgets—enough to get started with Bongo, at least. It took me only a few minutes to dope out where all the software controls were and roughly what they did, and I was able to intelligently modify samples almost from the start.

The Bottom Line

The Castanet tuner is so unprepossessing on installation that some users will forget it's there until they need to use a channel, and then they may need a moment to remember how to use it. The transmitter and putback interfaces take a little getting used to, and Bongo presents a slightly steeper learning curve. Once these products emerge from beta testing, I expect that they will have easier-to-use knobs and buttons.

Castanet's scalability is an unanswered question. Marimba claims that Castanet exceeds the company's expectations and should be able to handle millions of users through a single uniform resource locator (URL), although I wasn't able to test this claim. The bigger question is whether Castanet will catch the fancy of end users and content providers. But with clever, paradigm-shifting technology and Marimba's knack for capturing mind share, Castanet has as good a chance as any to be the vehicle that brings Web applications to the masses. **B**

Pete Loshin is a technical editor for BYTE reviews and author of TCP/IP Clearly Explained *(Academic Press Professional, 1997). You can reach him at* **ploshin@bix.com**.

TECH FOCUS PERFORMANCE

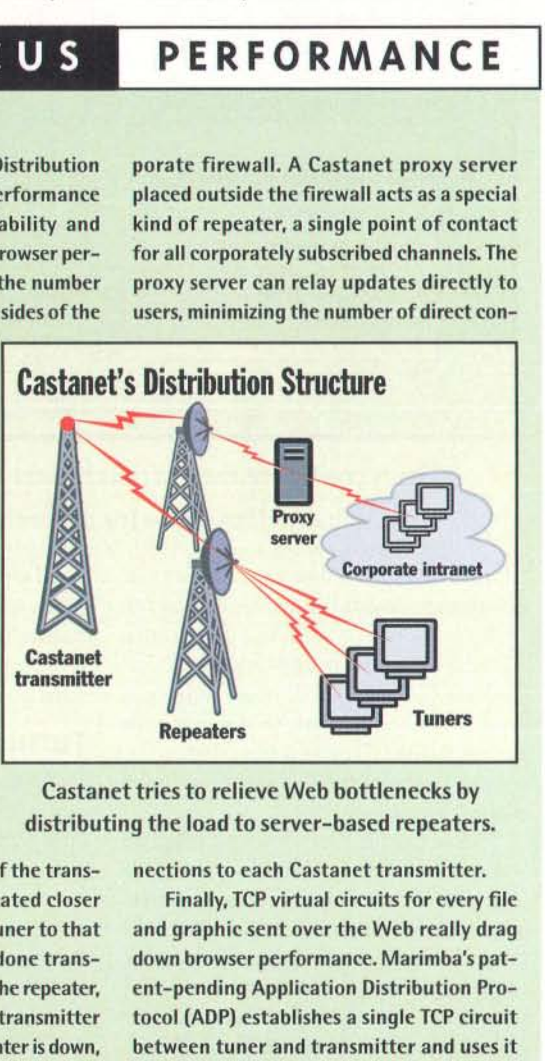
How Big, How Fast?

Marimba's Castanet Software Distribution System approaches the Web-performance problem from two sides: scalability and browser performance. Because browser performance typically degrades as the number of users increases, these are two sides of the same coin. The Castanet architecture approaches the problem by simplifying distribution through proxies and repeaters, thus splitting up bandwidth issues among a number of distributed systems. Instead of a single transmitter serving all tuners, repeaters are placed where they are needed to keep all channels up-to-date for local users and to improve users' performance by eliminating the need for transoceanic and transcontinental Web links.

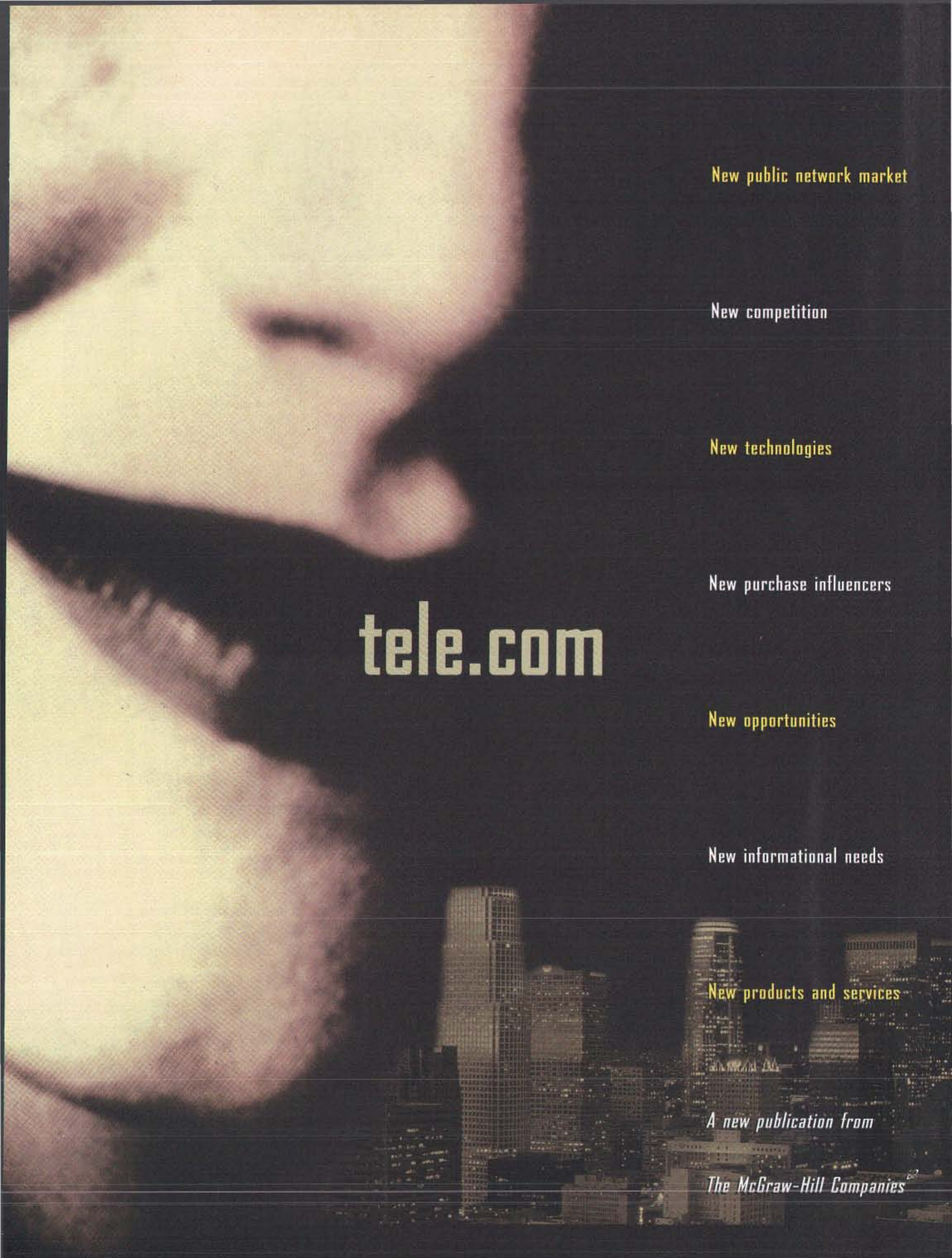
Castanet balances loads by making all tuners connect initially to a main transmitter when subscribing to a channel. If the transmitter has a repeater that's located closer to the subscriber, it points the tuner to that repeater. Channel updates are done transparently, between the tuner and the repeater, which is kept up-to-date by the transmitter (see the figure above). If the repeater is down, the tuner is smart enough to go back to the original uniform resource locator (URL) and obtain the update directly from the transmitter (or get referred to another functional repeater).

Bandwidth is an issue for subscribers, too, if they happen to be sitting inside a corporate firewall. A Castanet proxy server placed outside the firewall acts as a special kind of repeater, a single point of contact for all corporately subscribed channels. The proxy server can relay updates directly to users, minimizing the number of direct connections to each Castanet transmitter.

Finally, TCP virtual circuits for every file and graphic sent over the Web really drag down browser performance. Marimba's patent-pending Application Distribution Protocol (ADP) establishes a single TCP circuit between tuner and transmitter and uses it to update all channels at once, eliminating a huge amount of protocol overhead. Incremental updating of code and data also helps to reduce the amount of network traffic. Marimba says that it's patenting ADP to retain control over its early development, much as Sun retained control over Java.



Castanet tries to relieve Web bottlenecks by distributing the load to server-based repeaters.



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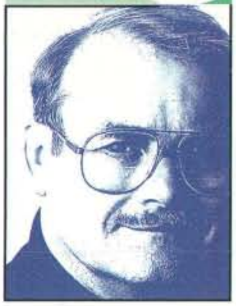

Of Bug-Hunting and a New Frontier

You can't always predict the way two programs will interact—but you can be sure graphics design will never be the same.

Some trite phrases are true. In particular, things often really aren't what they seem, especially if you're bug-hunting.

It all started when I installed a Zip drive on Old Cow, the 486DX2 that sits upstairs in my monkish cell. For those who've tuned in late, I've converted Alex's old room into a bare-bones place to write: no books, no games, no modem, and, most of all, no phone. I go there 2 or 3 hours a day to write fiction. There's nothing else I can do up there. It's the best thing that's happened to me in years; I've averaged more than 1000 words a day since I started that regime.

There are logistical problems. Old Cow isn't on my network, and putting him there would defeat the whole purpose, but I do need a way to bring down the results of my work. That means not only Word files—text, work record, dictionaries—but my Info Select notes, and my journals, which I keep in Franklin Quest Ascend. All that is too large to fit on a floppy disk, so a parallel Zip drive was the obvious answer.

The problem was Ascend. That subdirectory has a lot of files in it. Most of them don't change from day to day, but they can: Ascend keeps separate files for calendars, appointments, special tasks, Red Tab tasks, the phone list, journal, daybook, and some others. Zip drives are fast enough that I could just copy and overwrite all the files, but when I was using floppy disks to transfer this stuff, it was painfully slow, so I fell into the habit of copying only the files I had modified.

Alas, Microsoft Windows 95 Explorer doesn't have a way to copy only later files. My first way around that was to use Norton Commander in a DOS window. Over the years, I've gotten into the habit of using Commander for nearly everything, and my fingers know the keystrokes down to a cellular memory level. I'd simply order the files by date (F9-L-M in Commander's sequence), use the right mouse button to select all files recently modified, and press F5 to copy them.

Unfortunately, Commander is a bad habit I ought to break. It doesn't understand long filenames, and worse, if it does transfer a long filename, it truncates it into one of those eight-plus-three-with-a-squiggle filenames; and once it has done that, you'll never get the long filename back without renaming it. I keep hearing about a Win 95 version that fixes this, but I sure don't know how to get it.

Over the years, I've gotten into the habit of using Commander for nearly everything.

A better choice would be the shareware program Windows Commander, but, alas, it is published by a chap in Switzerland who makes it exceedingly hard to send him the registration fee unless you're on CompuServe, which I'm not; and the program makes increasingly ominous threats to those who haven't registered. It's also not all that easy to install.

The best solution is one I've recommended before: Canyon Software's Drag And File Gold Desktop (DAFGD). This understands long filenames, and while the interface isn't the old, familiar Norton Commander display—it looks a lot like Explorer—it will do all Commander can do and more.

Some of the features aren't obvious, and I really miss Commander's F3 to view and F4 to edit a selected file, but an hour's spelunking in DAFGD will reward you with a utility that does almost everything you would want a file utility to do. You'll particularly want to look in both the Options and Actions menus. You'll also want to examine the iconic buttons on the toolbar, and if you don't understand what some of those commands do, find out: most are useful.

Alas, I hadn't done that spelunking. Worse, I began to have what I thought were problems with DAFGD not copying things. I would drag the Ascend directory to the Zip drive, select the "copy newer files only" button, watch what looked like file transfers—and then discover that the files hadn't been transferred.

This was infuriating, and I called Canyon Software in high dudgeon. They were extremely interested, because although I had an older version of DAFGD, there doesn't seem to be any mechanism to cause that particular failure. I went through the problem while I was on the phone: open Ascend on the C drive, look at the task list to be sure it hadn't been updated, close Ascend, and then use DAFGD to drag the Ascend directory with its updated files from the Zip drive to the C drive with the "copy newer files only" option set.

The result was no result: the Ascend files were not updated. This time, though, I went back to look at the actual dates of the files—you can sort by date in DAFGD exactly as you do in Windows 95 Details view, by clicking on the category name in the toolbar, Modified in this case—and discovered to my horror that all the Ascend files on the C drive were now later than those on the Zip drive. Indeed, they were not merely later, they were about 1 minute old.

continued

PHOTOGRAPH: THEO FRIDLIZIUS © 1997

Ascend rewrites all its files when you close the program. It does this whether or not you have modified that file. DAFGD was doing precisely what it was supposed to be doing.

All's well that ends well. The result of all this is I've discovered just how useful DAFGD can be. Just about every feature I liked in Norton Commander is hidden in there somewhere; and unlike Windows Commander, it's easy to get and pay for DAFGD.

You can install it on a server—we have ours on Spirit, a Windows NT server off in the back room—and run locally. The only penalty for that is when it first comes up, DAFGD sorts and examines the directory it sits on, and that's the big 4-GB hard drive in Spirit, so it does take a few seconds. It isn't all that long a delay, and if what you wanted to do was send stuff to the server—that's often the reason I invoke DAFGD—you'd have to let it do that anyway. There's also a nifty toolbar addition utility that lists all your drives, local and networked, so you can choose any one of them instantly.

All told, Drag And File Gold Desktop is about the most useful file utility I have at Chaos Manor. Highly recommended.

In the past year or so, there's been what amounts to a revolution in computer graphics. Capabilities previously available only on Silicon Graphics systems costing six figures are now available at modest costs. Moreover, every week my local papers have articles about start-up graphics workshop companies. It's a growing and lucrative field for those with talent and understanding of computer graphics.

We get to look at a lot of graphics equipment. Testing it is a problem, because I don't do much graphics work, and certainly nothing that pushes a system to its limits. Fortunately, David Em does. David is a fine artist who many years ago discovered computers as an art medium. *The Art of David Em* was once my book of the month. He has had exhibits in institutuions including the Museums of Modern Art in both Paris and Madrid.

The following is more his report than mine and is based on his impressions from using a great deal of high-end equipment. Naturally we can't possibly look at everything; on the other hand, we did look for stuff we thought might be competitive. I asked David to recommend three graphics systems: beginner, serious user willing to spend a little money, and high-end professional. Here's the result.

First, surprise! At the high end, PCs may be better than Macs for 3-D graphics; certainly they're competitive. That wouldn't have been true six months ago. For 2-D work, it's a dead heat. Adobe Photoshop is the vital program for image processing, and the performance is indistinguishable in top-end NT and Apple machines. Also, Photoshop 4.0 can take advantage of multiple processors, and PCs have a head start in that area; on the other hand, multiprocessing is finally becoming a reality for Macs (for details, see "The Mac Goes Multiprocessor" on page 59).

As reported in a previous column, Intergraph's dual-processor TDZ-400 NT system is about as high end as you can get. It's not cheap, but you'll get your money's worth, everything is integrated, and their technical support and service are legendarily good. They've also just announced a new series of more midrange NT workstations. We haven't seen those yet.

If you build your own high-end system, there are three major video boards that we can recommend from experience: Matrox, Diamond, and Intergraph. Since their performance under NT 4.0 depends on drivers, some of them just coming out, we don't have a full report, but clearly they all are good enough. Be warned: if you plan to use Kinetix/Autodesk's 3D Studio Max, you need a board with "HEIDI" drivers, Kinetix's own driver standard, on top of the OS drivers.

On the low end, there are some rock-bottom limits. First, no graphics board with less than 4 MB of some kind of RAM and a GLINT chip is worth considering. Even 8 MB of RAM isn't too much, if you're planning to use 1280 by 1024 pixels or higher resolution. In this product segment, Diamond and Matrox are the main contenders; either is good enough. Second, you shouldn't consider anything less than a good Pentium or Pentium Pro. Be sure there is 512 KB of level 2 cache memory. Serious graphics work starts at 32 MB of RAM; you'll be miserable with less. At 64 MB your life gets better, and 512 MB is not too much for a high-end system; in a word, if you're buying a machine for graphics, be sure it will hold a lot of memory even if you can't afford all that memory at first.

Dual-processor systems are enough better than single that you'll be happier with, say, twin 150 Pentiums than with a

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single 200. (We lent David our DFI Doubleshot 133 dual-Pentium system after he had problems with his own machine. He loves it.) Whatever the central processor, you will want Fast and Wide SCSI (or Ultra SCSI) and the biggest hard drive you can afford. Graphics files are big, they have to be backed up frequently, and there are large database files to merge in.

Beginners wanting something to play with can get away with less than twin 150 Pentiums and Fast and Wide or Ultra SCSI, but if you start doing professional work, you'll upgrade fast. All this system speed affects not only productivity but creativity: if you have to wait forever for the output, you won't experiment, and if you don't experiment, you won't be doing your best work.

Third, whether beginner or pro, you'll want the best monitor you can afford, with excellent, accurate color reproduction. (I could do an entire column on monitors. Don't choose yours by specifications. Look before you buy.)

In monitors, bigger is better, but color fidelity is more important than size. I'm sure there are other excellent monitors, but the brands we're familiar with are Nanao and the higher-end ViewSonics. The ViewSonic P815 MegaMonitor is at present the best value for the money in a 21-inch monitor. Its nearest competitor is the 21-inch Nanao, and the ViewSonic P815 MegaMonitor is two-thirds the Nanao's price and has capabilities the Nanao doesn't have. In particular, you can run the P815 MegaMonitor in an astounding 1800- by 1440-pixel resolution, although you'll have trouble finding a board and drivers to do it justice. (We used an Artist Graphics board that was supplied by ViewSonic.)

You want a big monitor so you can see more of your work at once, of course, but there's another reason: once you get working hard, you'll have a whole bunch of little windows, palettes, textures, brushes, etc., open on the desktop, and it gets crowded. One remedy is to get a graphics board that supports two monitors (Macs do this automatically). That way, you can use an inexpensive monitor for the administrative details and the expensive one exclusively for your work. Alas, in PCs the two monitors must have the same resolution and scan rate.

Adobe Photoshop is the standard for image processing; for creating moving graphics, there are three top contenders.

continued

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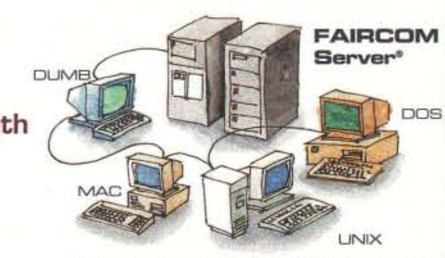

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First, there's Softimage 3D, recently acquired by Microsoft and adaptable to a number of plug-ins. Softimage 3D costs from $8000 to $13,000. It performs about as well in NT as on a Silicon Graphics machine, and it's in use in a number of professional studios. You need a computer on their approved list to buy it.

The second contender is Kinetix/Autodesk's 3D Studio Max at $3495, successor to the DOS-based 3D Studio, which David thought had one of the world's worst user interfaces; 3D Studio Max's is incredibly improved. Finally, there's NewTek's LightWave at $1495. All three programs are very powerful compared to anything you could have bought a few years ago, and each is used to turn out computer graphics for TV and movies on a daily basis. There are plug-ins for both of the less expensive programs that will significantly help their performance.

I can recall when something this good cost more than a whole system would now.

The more expensive programs are faster and have better animation capabilities, and there are more top-end people using them; but you'll be pretty far up the ladder before you notice the limits on any of these.

If you have or get a Mac, get Strata StudioPro. It's not as fast as some other graphics creation programs, but David promises that you'll love it. If you're going to get a Mac, get one with a PCI bus so you have some choices in video boards and add-ins, not one of the less expandable "all-in-one" machines.

It's unlikely that you'll have a printer good enough to do this quality of work; they're too expensive, and you don't need them that often. If you want your work printed, you go to a print service house. (You'll want a Zip drive to carry your data there; even Kinko's has Zip drives on their machines now.) Syquest's EZ135 removable drives are still quite serviceable, but they just don't have the market share they once did. One big advantage to the Mac is that most print houses find it easier to handle Mac files. NT is catching up in printability, largely by reverse-engineering the way the Mac does it, but for probably another year, you'll have less trouble getting printed copy with Mac files.

David also recommends Fractal Design's Ray Dream Studio for beginners. It has a little of everything, lights, shadowing, textures, and is a great way to learn.

Finally, you'll want the Wacom ArtZ II 6- by 8-inch Graphics Tablet. They make larger ones, but David finds he prefers the small one that he can put in his lap. You just can't use a mouse, or a trackball, to do serious drawing, and the Wacom ArtZ II will coexist with a mouse, so you can use whichever is more appropriate.

It's a sign of the times that STB Systems has a wonderful 2-D board, the LightSpeed 128, for under $200, that blows away the competition. For games and casual use, you can't get more bang for the buck. The lack of 3-D capability makes it doubtful you'll keep the LightSpeed 128 as part of a serious graphics system, but it's good enough to get started, and it's certainly more than good enough for anything but professional graphics work.

I can recall when something this good cost more than a whole system would now.

I got started in this business in 1976, when I borrowed $12,000 to buy a Z80 system and a Diablo daisy-wheel printer. For that or less today, you can get a system good enough to get into the booming graphics business. You also have the same dilemma I did: bang for the buck rises steeply every quarter, but if you wait, you're that much longer getting into the game. I didn't wait, and I don't regret it.

Maybe you don't want to become a professional artist; maybe you just want to dress up a presentation now and then.

RT Computer publishes Native American and Western clip art. At the moment, their collections come on 3½-inch disks (four or five in each package), but I expect them to be moved to CD-ROM by the end of the first quarter. Meanwhile, there's The Wild West Collection with cowboys, mariachi bands, bucking broncos, and the like; The Petroglyph Collection of southwestern petroglyphs, both authentic and modern (at least I am assuming that the petroglyph of a primitive stone computer is modernized, but it could come from an early issue of BYTE); The Plains Collection; and The Sante Fe Collection of Hopi, Navajo, and other Southwestern and Native American artworks. It's all royalty-free. If you want to dress up a presentation with something unusual, look into these.

RT Computer also makes PROZip, a wonderful drag-and-drop zip control utility. Unfortunately, I don't have room for a full report here, but check the BYTE Web site (http://www.byte.com) for details.

Interplay Production's Conquest of the New World can drive you nuts.

This game could easily have been the game of the year. It may yet, but the shipping version is nearly unplayable.

There is an official strategy book; indeed, the strategy book is what got me interested in the game, which is a sort of sixteenth-century Sim City with conquest and slaughter. The game is difficult enough that I advise you to get the strategy book, although I generally resent being required to buy what ought to have been included in the manual.

The game is complex, and it doesn't forgive mistakes in either management or battles. Battles are stylized but demand good strategy and tactics. There's a battle practice feature in the opening game menu. You'll need it.

Then come the bugs. First, the naval actions: Ships are very expensive, particularly the higher grades, and in the early stages of the game, you don't have a lot of money; but if you go to the great expense of building a high-quality ship and stocking it with good troops, you may get the miserable experience of having it captured by native canoes or inferior vessels costing a tenth what your expensive galleon cost. Your ship can even be lost despite being in a dock protected by a fortress.

There's worse. I hate fighting a table of random numbers, but at least you can play a turn over if you don't want to waste the time of rebuilding the ship—except you can't. Conquest records automatically: you can't lose a battle, quit, and play over. The programmers have decided they don't want you to do that and have gone to great lengths to prevent it.

They also encrypted the save files, which suggests this game was designed by programmers who hate gamers. They did not want you hacking the save files with Norton Diskedit; you'll play the game their way or not at all. I find this repulsive enough to begin with, but it's inexcusable when the game has serious bugs. Sometimes units won't move. Sometimes this is linked with naval battles. Other times, land units that once were aboard a ship will

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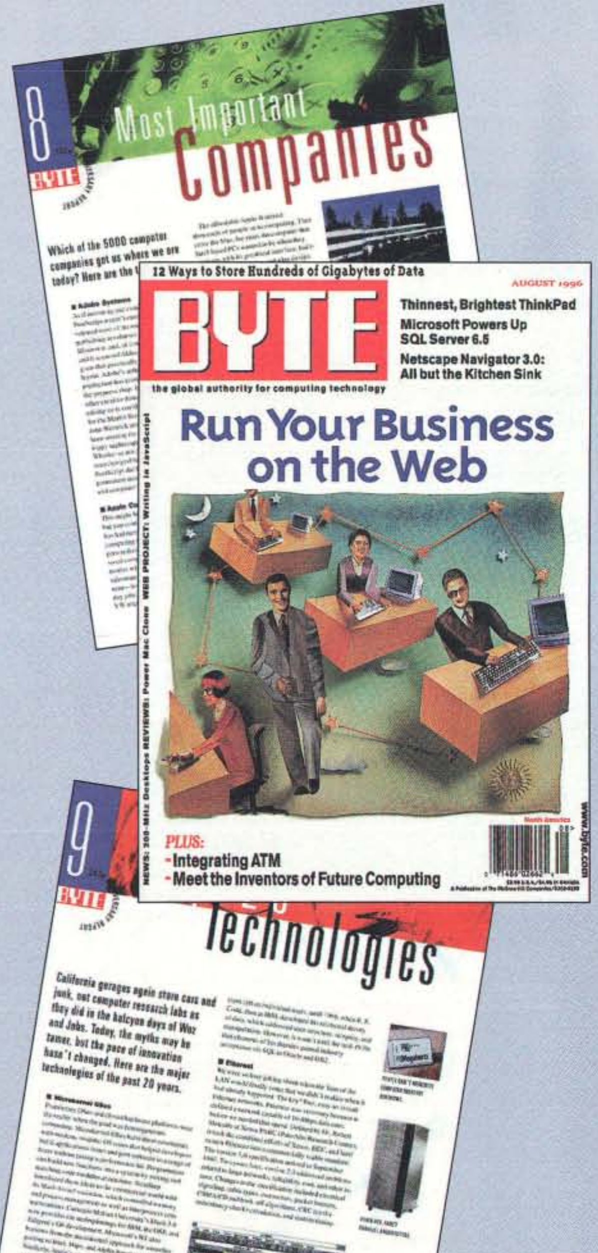

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9 Technologies

California garages again store cars and junk, not computer research labs as they did in the halcyon days of Woz and Jobs. Today, the myths may be tamer, but the pace of innovation hasn't changed. Here are the major technologies of the past 20 years.

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A Division of The **McGraw-Hill** Companies be stuck in place, unable to go anywhere. If you attack an enemy ship with two of yours, you may win both the battles but find one of your ships has vanished: not sunk, not captured, just vanished. Troops that have just won a battle but have taken casualties are unable to march back into the fortress they came out of, and stand exposed and wounded turn after turn while you gnash your teeth in frustration. There are also conceptual problems: naval units in harbor under the protection of forts ought to be a lot less subject to attack than they are.

If they'd put the effort into fixing problems instead of making sure gamers don't cheat, they'd have had a decent game. There's a patch you can download from Interplay's Web page; it helps a lot, but it doesn't entirely cure the problems of stuck units.

Having said all that, I remain addicted to the darned thing long after I should have used the CD as a coaster—in the microwave. When it's working well, Conquest of the New World is up there with Blizzard Entertainment's Warcraft II: Tides of Darkness and Strategic Simulations' Fantasy General. Alas, as you get ahead and are about to win (which should be the fun part of the game), the bugs get worse, the frustration goes up, enjoyment goes down.

If you get Conquest of the New World, be sure to get the strategy book, download the patches, and keep watching Interplay's BBS for bug fixes. If they ever get the bugs out, it will be a wonderful game despite the encrypted data files.

The book of the month is G. Harry Stine's *Halfway to Anywhere*. This is part of the story of some of the most important events in the history of space travel told by one of the participants. Fair warning: I'm rather prominently in the book. If you want to know something about single-stage-to-orbit ships like the DC/X and the upcoming X-33, this is the place to start.

The computer book of the month is Jonathan Rosenberg's *How Debuggers Work*. This is a good general introduction to what happens when you tear into a program with a debugger. I suppose there was a time when no BYTE reader would need this book, since everyone knew about DDT and SID (early CP/M debuggers) and the program called DEBUG, which came with every copy of DOS. Those days are long gone, and I suppose it's just as well, but you really ought to know something about debugging and debuggers, and this book is a readable way to find out.

Last month, I spent a week in Spain gathering material for a novel. My wife rejoiced: I'd be away from modems and disconnected from the computer world for nine days. Then I mentioned Konexx. With Mobile Connector you can connect to virtually any phone, including digital and through a PBX; merely connect the Konexx Mobile Connector box where the handset goes, and plug the handset and your computer's modem or fax/modem into the Mobile Connector. Look up the level switch setting (1–4) for that phone and set the switch; or try all four settings until you find one that works. Now you can send and receive faxes, get on the Internet, collect your e-mail, etc.

Konexx also makes an Acoustic Coupler you can connect to the handset itself. It has its own Velcro straps to hold it securely in place, and it's adjustable to fit nearly any handset. This works even in the rare cases when the Mobile Connector fails.

It took Roberta about 5 seconds to react. I won't tell you what she said, but I didn't take the Konexx Mobile Connector with me. Thus, I can't report on how well it works with phones in Spanish hotels. However, the Mobile Connector works in U.S. hotels, including those that use a digital phone system. If you absolutely, positively have to get connected, get the Konexx Mobile Connector and Acoustic Coupler. Recommended.

After I file this, I'm headed for Comdex. I haven't heard of anything really astounding to be shown there, but I'm sure there'll be interesting surprises. Stay tuned. **B**

Jerry Pournelle is a science fiction writer and BYTE's senior contributing editor. You can write to Jerry c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please include a self-addressed, stamped envelope and put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on the Internet or BIX at **jerryp@bix.com.**

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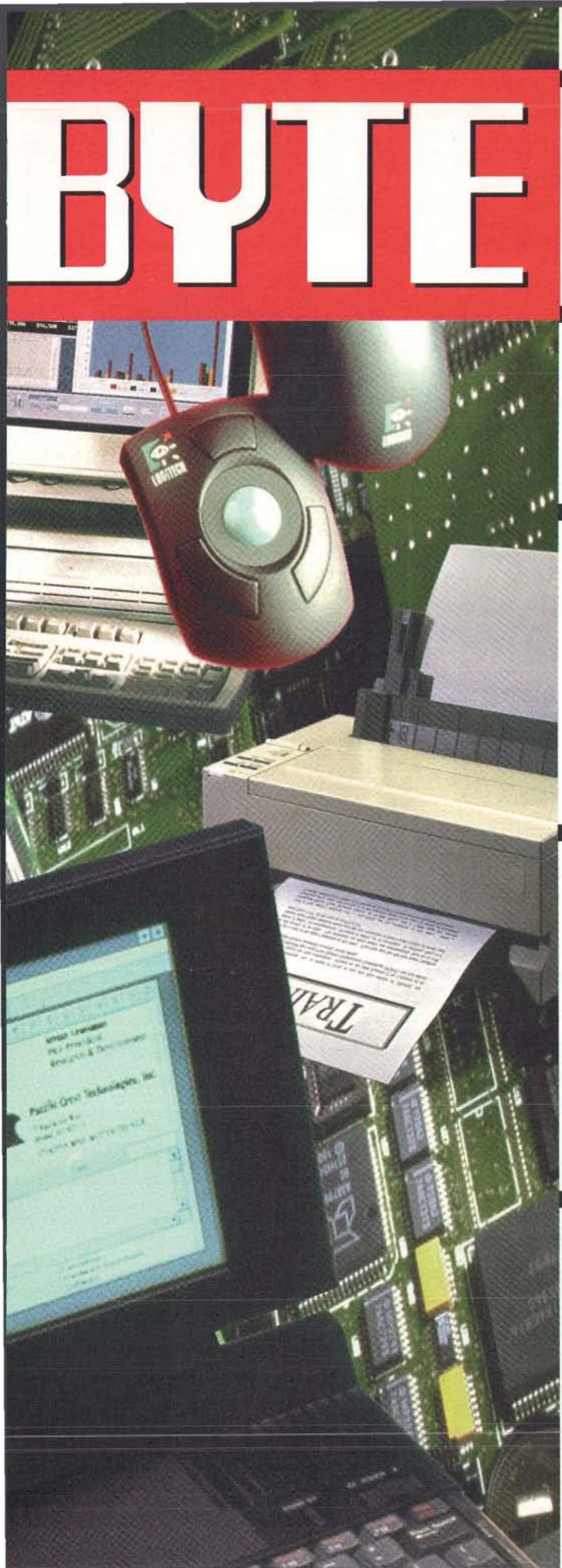

BUYER'S GUIDE

Essential Products and Services for Technology Experts

Mail Order

Top mail-order vendors offer the latest hardware and software products at the best prices. **Page 156**

Hardware/Software Showcase

Your full-color guide to in-demand hardware and software products, categorized for quick access. **Page 165**

Buyer's Mart

The BYTE classified directory of computer products and services, by subject so you can easily locate the right product. **Page 173**

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16MB	149320-001	$127	32MB	149147-001	$247
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16MB	147524-001	$114	32MB	147525-001	$220
1MB Video	171017-001	$49			
Presario 972, 974, 978, 982, 992, 5526. 5528, 5536, 9536, 9546, 9548, 9564, Prolinea 4100, 466, 5120MX, 575MX, 590MX, 5100, 5133, 5120, 5100, 575, 590, Prolinea 450, 5100e, 5120e, 575e, 6150e, 6180e, Deskpro 4100, 450, 466, 575MX, 590MX, 5100, 5120, 5133, 575, 590					
4MB	172712-001	$31	8MB	172713-001	$56
16MB	172714-001	$114	32MB	172715-001	$220
1MB Video	171017-001	$49			
256K Cache	223557-001	$49			
Presario 7212, 7222, 7232, 7234, 7240					
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16MB	236548-002, 236513-001	$108			
32MB	n/a	$228	64MB	n/a	$456
1MB Video	236709-001	$49			
Presario 9232, 9234, 9240, 9250, 9642, 9660					
8MB	234567-001	$62	16MB	234566-001	$108
32MB	n/a	$228	64MB	n/a	$456
1MB Video	213922-001	$49			
Prolinea 5133 2000/ML, 5150 2000/ML, 5166 2000/ML, 5100 840/1200, 5120 1200, 5133 1200/2000, 5150 1200/2000, 5166 1200, Deskpro 5133 2000/ML, 5150 2000/ML, 5166 2000/ML, 5100 840/1200, 5120 1200, 5133 1200/2000, 5166 1200/2000, 575 840					
8MB	243011-001	$62	16MB	243012-001	$108
32MB	243013-001	$228	64MB	243014-001	$456
1MB Video	171017-001	$49			
2MB Video	223335-001	$139			
6MB Video	223336-001	$369			
Deskpro XE 560, 5/66M, 5/60M					
16MB	149949-001	$148	32MB	149912-001	$284
64MB	149913-001	$508	128MB	149914-001	$988
1MB Video	139167-001	$89			
Deskpro XL 450, 466, 560, 566, 5100, 5120, 5133, 575, 590					
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32MB	148190-001	$254	64MB	148191-001	$494
1MB Video	139167-001	$49			
Deskpro XL 6150 1050/CDS, 2100/PD, XL 6200 2100/PD					
16MB	210948-001	$481	32MB	228417-001	$375
64MB	228418-001	$851			
2MB Video	223335-001	$139			
6MB Video	223336-001	$369			
Deskpro XE 4100, 433s, 450, 466					
4MB	141684-001	$45	8MB	141685-001	$82
1MB Video	139167-001	$49			
256K Cache	194358-001, 194358-002	$49			
Deskpro 3/25i, 3/33i, 386/25M, 386/33M, 4/25iS, 4/33I, 4/66i, 486/33M, 486/50M, 486/66M, 486s/16M, 486s/25M, 486s/33M					
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512K Video	141236-001	$39			
1MB Video	139167-001	$49			

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16MB	310-3327	$114	32MB	n/a	$220
Performance ME, OmniPlex Pentium ME, OptiPlex DGX, PowerEdge SP/XE/EL Models					
8MB	310-3335	$64	16MB	310-3336	$128
32MB	310-3337	$260	64MB	n/a	$462
PowerLine Workstations SE & DE Models					
8MB	310-2468	$74	16MB	310-2469	$142
32MB	310-2630	$254			
Dimension XPS & OptiPlex XL/XM/XMT Pentium Models					
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32MB	310-3375	$260	64MB	310-3368	$462

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32MB	501159-004	$254	64MB	501159-005	$494
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16MB	500987-004	$114	32MB	500987-005	$228
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4MB	34F2933, 87F9977, 6451060	$37			
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16MB	n/a	$114	32MB	n/a	$220
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16MB	D2676A	$127			

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Starion & Venturis Models					
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16MB	FR-PCVAM-AC	$114	32MB	FR-PCVAM-AD	$220

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16MB	C3146A	$119			
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16MB	FR-PCP8M-AC	$162			
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Extensa 550, 555, 560, 570 Models					
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TravelMate 5000, 5010, 5020, 5100, 5130, 5200, 5270, 5300 Models					
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16MB	8189113	$279			
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32MB	NW2034U	$293			
Tecra 500 Models & Portege 650CT					
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32MB	PA2040U	$393	48MB	PA2041U	$742
Tecra 700 Models					
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16MB	OP-410-4003	$197	32MB	OP-410-4004	$358
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32MB	OP-410-62003	$465			

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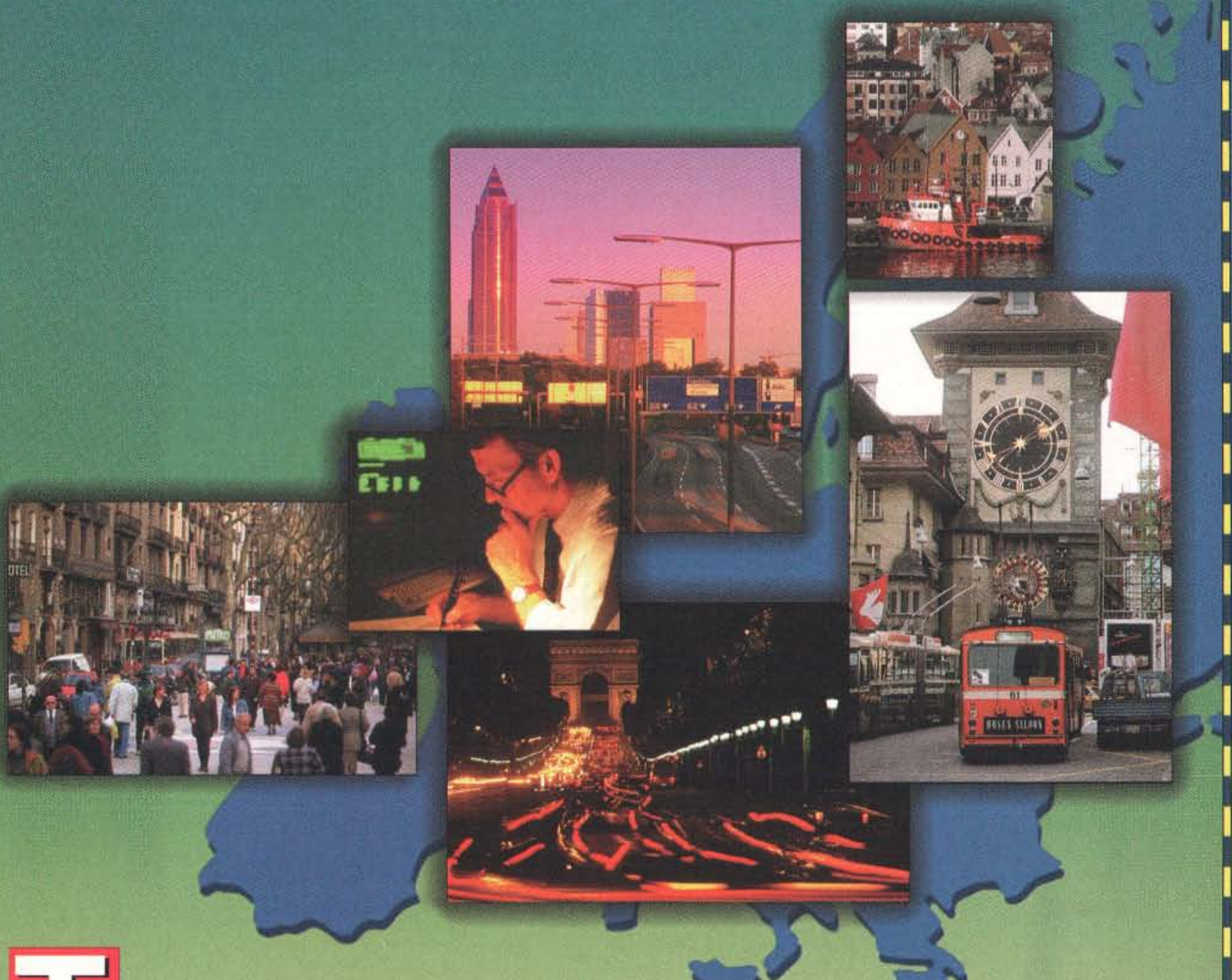
FIRST SOURCE INTERNATIONAL

Circle 203 on Inquiry Card (RESELLERS: 204).

BYTE's Pan-European Postcard Deck Targets Influential European Technology Experts



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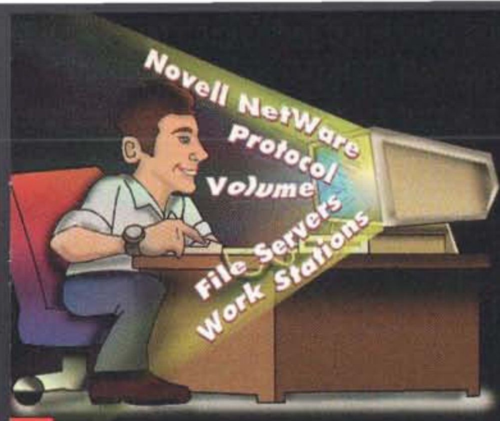

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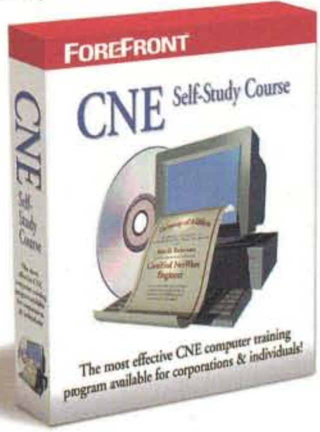
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Advantage Pro 486 SX33, SX25	4Meg/8Meg/16Meg/32Meg	34/69/124/229
Bravo LC	4Meg/8Meg/16Meg/32Meg	34/69/124/229
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Manhattan G, V (pairs)	8Meg/16Meg/32Meg	69/129/239
Premmia 4/33, 4/50, MTE 433 (pairs)	4Meg/8Meg/16Meg/32Meg	39/69/129/239
Premmia 4/660, SE 4/33, 4/66 (pairs)	4Meg/8Meg/16Meg/32Meg	39/69/129/239
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Pavillion 5010-7170 (pairs)	4Meg/8Meg/16Meg/32Meg	49/79/129/249
Vectra 500 (EDO, pairs)	4Meg/8Meg/16Meg/32Meg	49/79/139/269
Vectra VA 6/180, 6/200 (EDO, pairs)	4Meg/8Meg/16Meg/32Meg	49/79/139/269
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Aptiva A Series (pairs)	4Meg/8Meg/16Meg/32Meg	34/59/119/219
Aptiva C Series (EDO, pairs)	4Meg/8Meg/16Meg/32Meg	39/59/144/249
Aptiva M Series	4Meg/8Meg/16Meg/32Meg	34/59/119/219
PC 330 Models 6571-6576	4Meg/8Meg/16Meg/32Meg	34/59/119/219
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PC 340 (EDO, pairs)	4Meg/8Meg/16Meg/32Meg	39/59/144/249
PC 350 Models 6581-6585	4Meg/8Meg/16Meg/32Meg	34/59/119/219
PC 350 Model 6586 (pairs)	4Meg/8Meg/16Meg/32Meg	34/59/119/219
PC 350 Model 6587 (EDO, pairs)	4Meg/8Meg/16Meg/32Meg	39/59/144/219
PC 360	4Meg/8Meg/16Meg/32Meg	44/69/129/229
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PC 730 Model 6877 (EDO, pairs)	4Meg/8Meg/16Meg/32Meg	39/59/144/219
PC 750 Models 6885-6886 (pairs)	4Meg/8Meg/16Meg/32Meg	49/69/139/259
PC 750 Model 6887 (EDO, pairs)	4Meg/8Meg/16Meg/32Meg	39/59/144/219
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PC Server 500 (ECC, pairs)	4Meg/8Meg/16Meg/32Meg	59/79/119/249
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P/S 1, 72 Pin Simms	4Meg/8Meg/16Meg/32Meg	49/79/139/249
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P/S 2, 53, 53LS, 56, 57	4Meg/8Meg	49/79
P/S 2, 95XP (ECC, pairs)	4Meg/8Meg	49/79
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Thinkpad 701, 701C	4Meg/8Meg/16Meg/32Meg	50/89/169/719
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Deskpro 575, 5120, 5133, 5150, 5160 (EDO, pairs)	4Meg/8Meg/16Meg/32Meg	29/49/89/189
Deskpro 2000, 4000, 6000 Series (EDO, pairs)	4Meg/8Meg/16Meg/32Meg	29/49/89/189
Deskpro 5/60M, 5/66M, XE560 (quads)	2Meg/4Meg/8Meg/16Meg/32Meg	39/49/69/139/239
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Presario 510, 520, 524, 660, 720, 724, 860	4Meg/8Meg/16Meg/32Meg	29/49/89/189
Presario 920, 924, 954, 974, 978, 992	4Meg/8Meg/16Meg/32Meg	29/49/89/189
Presario 1000, 1010, 1020, 1030	8Meg/16Meg/32Meg	69/129/249
Presario 833, 850, 860, 866	4Meg/8Meg/16Meg/32Meg	39/64/119/239
Presario 5528, 7110, 7152	4Meg/8Meg/16Meg/32Meg	29/49/89/189
Presario 7170, 7180, 9536, 9546, 9548, 9564 (pairs)	4Meg/8Meg/16Meg/32Meg	29/49/89/189
Presario 9232, 9234, 9240, 9250, 9642, 9660 (pairs)	4Meg/8Meg/16Meg/32Meg	29/49/89/189
Proliant 1000 5/60, 2000, R, 4000, R (quads)	4Meg/8Meg/16Meg/32Meg	39/64/119/239
Proliant 1500, 1500R (pairs)	4Meg/8Meg/16Meg/32Meg	39/64/119/239
Proliant 4500, 4500R (quads)	4Meg/8Meg/16Meg/32Meg/64Meg	39/64/119/239/599
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Prolinea (enhanced), MT	4Meg/8Meg/16Meg/32Meg	49/69/129/229
Prolinea 575, 590, 5100, 5120, 5133 (pairs)	4Meg/8Meg/16Meg/32Meg	39/69/119/239
Prolinea 5100, 5120, 5133, 5150, 5166 (EDO pairs)	4Meg/8Meg/16Meg/32Meg	39/69/139/259
Prolinea 575E, 100E, 120E, 575MX (pairs)	4Meg/8Meg/16Meg/32Meg	39/69/119/239
Prolinea 590MX, 5120MX (pairs)	4Meg/8Meg/16Meg/32Meg	39/69/119/239
Prolinea 6150E, 6180E (pairs)	8Meg/16Meg/32Meg	69/119/239
Prosignia 300 5/75, 5/90, 5/120, 5/150 (pairs)	4Meg/8Meg/16Meg/32Meg	39/69/119/259
Prosignia 500 5/90, 5/120, 5/150 (pairs)	4Meg/8Meg/16Meg/32Meg	39/69/119/259

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Concerto 4/25, 433	4Meg/8Meg/16Meg	79/99/169
Contura 4/25, C, CX	4Meg/8Meg/16Meg	79/99/169
Contura 400C, 400CX, 410C, 410CX	4Meg/8Meg/16Meg	79/99/169
Contura 420C, 420CX, 430C, 430CX	4Meg/8Meg/16Meg/24Meg	49/79/169/239
Contura Aero 4/25, 4/33	4Meg/8Meg/16Meg	69/99/169
LTE 5000, 5100, 5200, 5300	8Meg/16Meg/32Meg/64 Meg Kit	89/149/266/513
LTE Elite 440C, CX, 4/75CX	4Meg/8Meg/16Meg/24Meg	49/89/179/249
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Canon LBP 430	–	–	39	–	–	–	49	–	–	–	–	–
Canon LBP 860, 1260	–	–	–	19	–	–	49	–	–	79	119	229
Canon LBP4, 4Lite, 4plus	–	–	129	179	–	–	–	–	–	–	–	–
Epson 6000, Action Laser	–	–	–	79	–	–	149	–	–	–	–	–
Epson Action Laser 1100, 1600	–	–	19	29	–	–	79	–	–	109	239	–
Epson Action Laser II	–	–	74	–	173	–	–	272	–	–	–	–
Epson 8000, 1800, 4000, 4100, 4300	–	–	89	–	173	–	–	272	–	–	–	–
Epson 1000, 1500, 5000, 5200	–	–	–	69	–	–	138	–	–	–	–	–
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IBM Laser 4029, 4037	–	–	–	–	–	–	69	–	–	–	–	–
IBM Laser 4039, 4079	–	–	–	***39***	–	–	***69***	–	–	***99***	–	–
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Lexmark Medley 4C, 4x, 4SX	–	–	Call	Call	Call	–	–	–	–	–	–	–
Lexmark, Optra L, LX, R, RX	–	–	–	–	–	–	49	–	–	69	109	239
Lexmark Valuwriter 300,600	–	–	29	39	–	–	89	–	–	–	–	–
Lexmark Winwriter 200, 400, 600	–	–	29	39	–	–	89	–	–	–	–	–
NEC 90, 290	–	–	–	89	–	–	–	–	–	–	–	–
NEC 95, 97	–	–	–	79	–	–	–	–	–	–	–	–
Oki 400	–	–	–	79	–	–	–	–	–	–	–	–
Oki 400E, 400EX, 410E, 410EX	–	–	89	109	189	–	189	–	–	–	–	–
Oki 810E, EX, 600E, EX, 610E, EX	–	–	29	39	–	–	69	–	–	99	129	–
Oki 830, 840	–	–	–	89	–	–	–	–	–	–	–	–
Oki 2350, 2450	–	–	Call	Call	–	–	–	–	–	–	–	–
Panasonic 4420/4450i	–	–	–	99	–	–	169	–	–	–	–	–
Panasonic 4410/4430	–	–	–	***89***	–	–	***129***	–	–	–	–	–
Panasonic 4450	–	–	89	–	–	–	–	–	–	–	–	–
Panasonic 4400/5400	–	–	89	99	–	–	189	–	–	–	–	–
Panasonic 4440, 5410	–	–	79	99	–	–	159	–	–	–	–	–
Panasonic 6500	–	–	14	29	–	–	79	–	–	–	–	–
Sharp 9400, 9460, 9600, 9700E	–	–	69	99	–	–	149	–	–	–	–	–
Sharp 9500, E, H, 9700, H	–	–	79	–	–	–	259	–	–	–	–	–
TI XL/PS17/PS35	–	–	49	–	–	–	–	–	–	–	–	–
TI Microlaser Pro E, Powerpro, Pro 600	–	–	89	129	–	–	189	–	–	329	–	–
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Compaq LTe 5000 Series	109	TI Extensa 450, 455, 510, 515	139
Epson Action Note 650, 660	162	TI Extensa 550, 555, 560, 570	149
Epson Action Note 800, 866, 880, 910	154	TI Extensa 600, 605, 650	181
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Tecra 710, 720	***8Meg/16Meg/32Meg/64Meg/128Meg***	***99/169/309/1020/2040***
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T4500, C, T4600, T4700, T1900, C, T1910, T1950 (3.3 v)	8Meg	79.00
T4500, C, T4600, T4700, T1900, C, T1910, T1950 (3.3 v)	16Meg/32Meg	159/279
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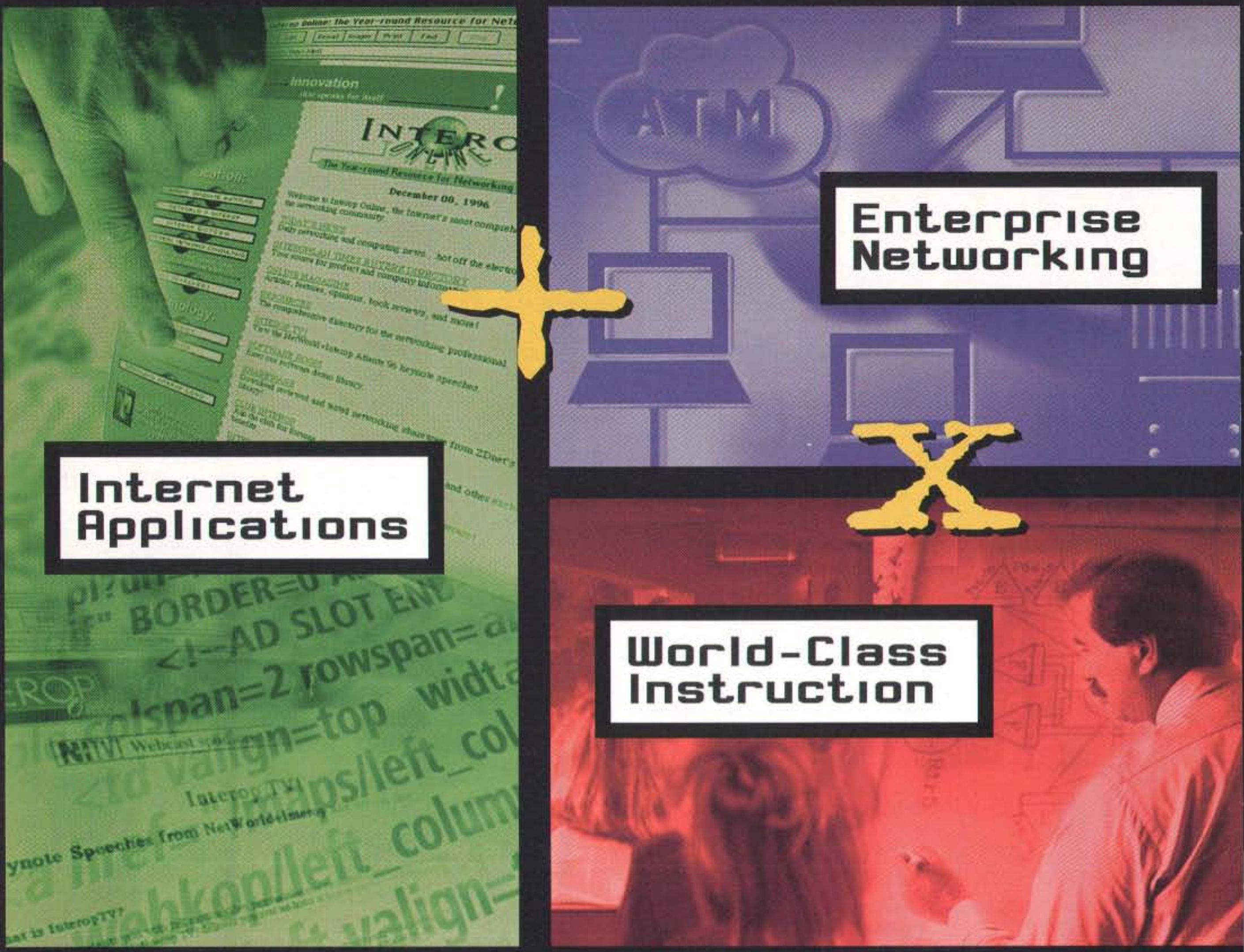

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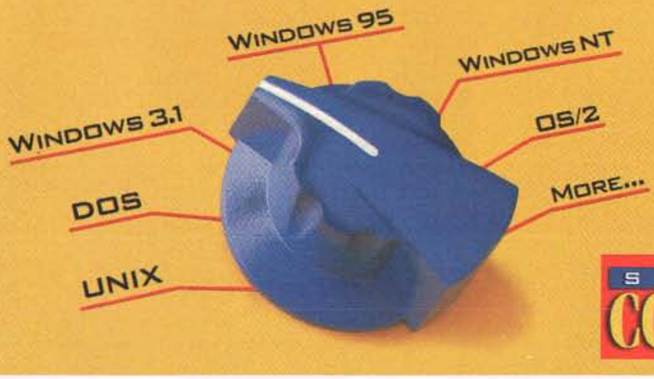

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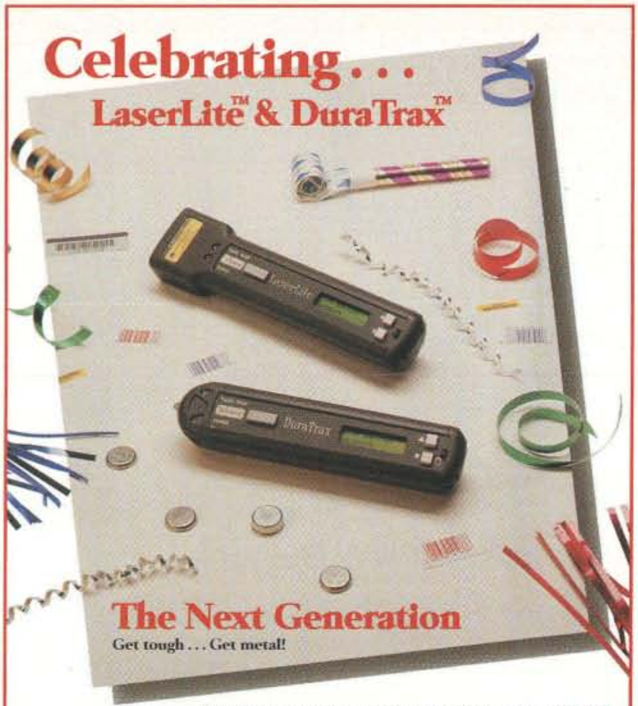

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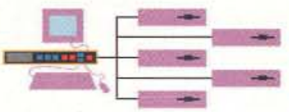

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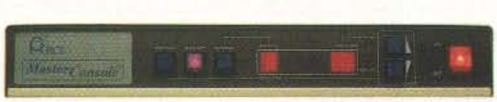

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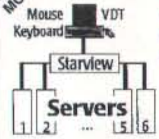

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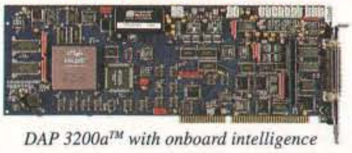

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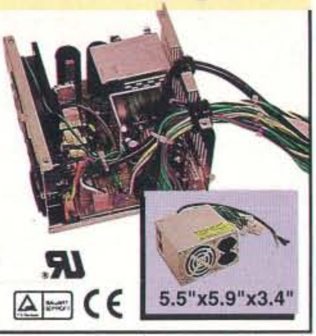

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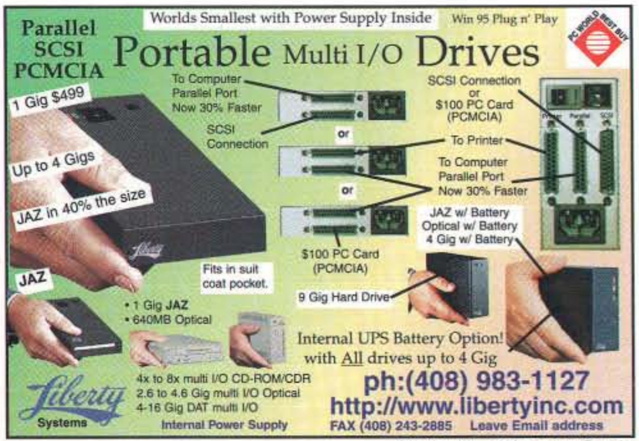
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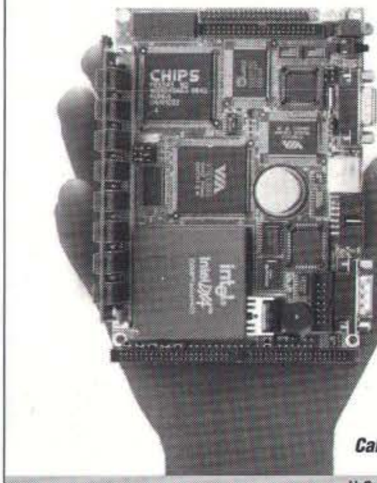

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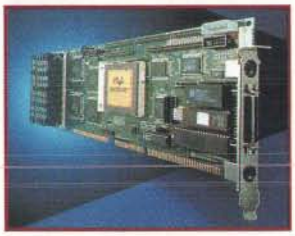

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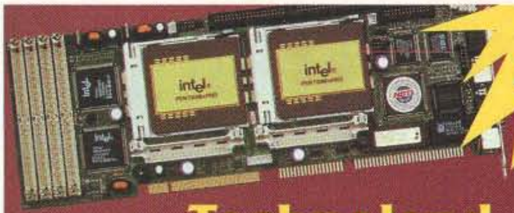

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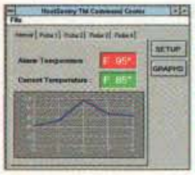

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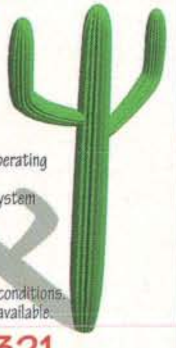

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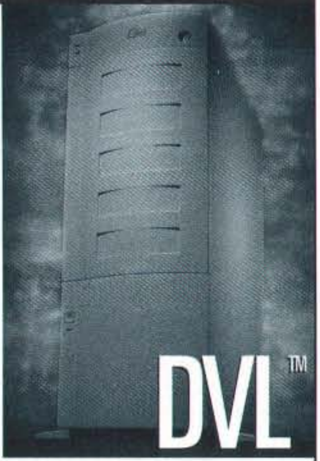

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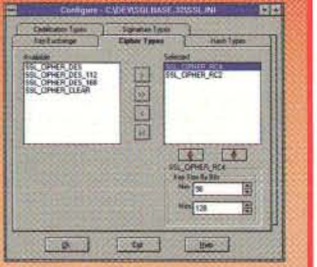

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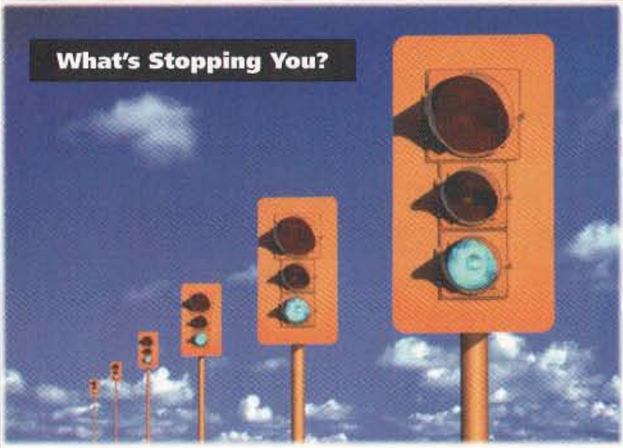

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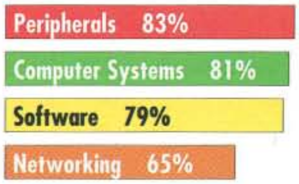

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16 ☐ Operations/Manufacturing
17 ☐ Systems/Networking
18 ☐ Systems Engineering/Integration
19 ☐ Department Management (non-IS/MIS)
20 ☐ Consulting
21 ☐ Other (Please specify): ______

C. Do you evaluate, specify, recommend, purchase: (Check all that apply)
22 ☐ Application Development Products
23 ☐ Networking/Communication Products
24 ☐ Operating Systems
25 ☐ Large Systems (Mainframes/Minis)
26 ☐ Desktops (Micro's/Workstations)
27 ☐ Systems Software Products
28 ☐ Application Software Products
29 ☐ Peripheral Equipment
30 ☐ Telecommunications Services

D. How many people are employed at this location and your entire organization:

At this location		Entire Organization
31 ☐	10,000+	37 ☐
32 ☐	5,000-9,999	38 ☐
33 ☐	1,000-4,999	39 ☐
34 ☐	500-999	40 ☐
35 ☐	100-499	41 ☐
36 ☐	Under 100	42 ☐

E. What is the scope of your purchase involvement?
43 ☐ Company wide
44 ☐ Division wide
45 ☐ Department wide
46 ☐ Individual

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88	STARTECH COMPUTER PRODUCTS	**166**	800-265-1844 ext 231
152	STATSOFT	**89**	918-749-1119
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749-750	TATUNG	**40IS 29**	+886-2-592-4569
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*InformationWeek, July 29, 1996.

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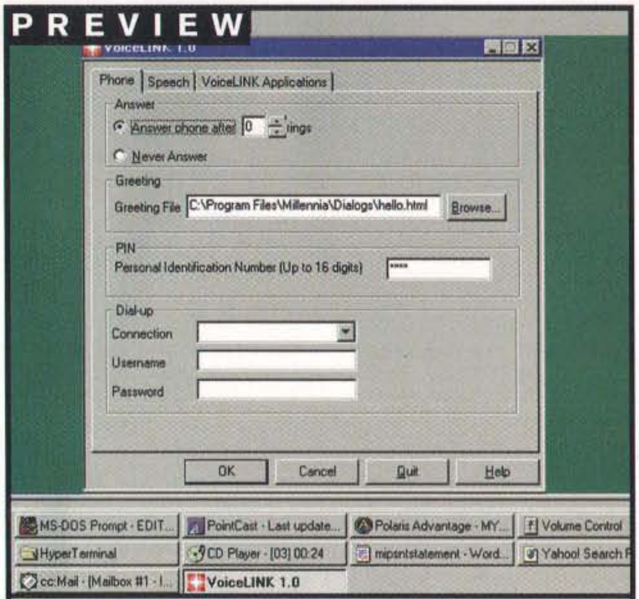

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Retrieve E-Mail Without a PC

Millennia's Email Reader lets you dial your desktop PC and listen to your e-mail using a plain old telephone instead of downloading your messages to a notebook PC. Once you install Email Reader on a Win 95 PC equipped with a 75-MHz or faster Pentium and a voice modem (I used one from Boca Research), you can dial in using a telephone or cellular and listen to your e-mail.

Email Reader lets you manage your mail by pressing certain keys on your touch-tone phone or by actually speaking to the computer. Whether using touch-tones or voice, you can tell the program to list, mark as read or unread, play, or perform other operations on messages. The program supports Microsoft Exchange, Netscape, Eudora, and other POP3 Internet e-mail reader software.

I think Email Reader is probably best for someone who gets a low number of messages per day or who wants to monitor e-mail while away for a day or so: It can be aggravating listening to even just the headers of 20 or 30 new messages over the phone. In high-volume scenarios, Email Reader would work best if used with e-mail programs that support rules-based processing. The current Email Reader is a stand-alone program, but a network version is planned, as are other mail processing modules, so we'll monitor this telephony category as it matures. **–Dave Andrews**

Business

Intranet Productivity Suite

AVAILABLE FOR WINDOWS 95 AND NT, THE Distinct IntraNet Suite ($425) includes Distinct NFS 95 for sharing files, programs, and printers across heterogeneous networks; Distinct NetRover, a corporate Internet access solution that includes a Web browser, multiconnect FTP, and a newsreader and mail; Distinct IntelliTerm terminal emulation for IBM and DEC; and Distinct IntraNet Servers for managing network resources.
Contact: Distinct Corp., Saratoga, CA, (408) 366-8933; http://www.distinct.com.
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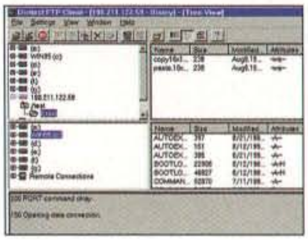

Add More Pert Charting to Microsoft Project

WITH PERT CHART EXPERT (SINGLE-USER, $199), you can add more Pert charting capabilities to Microsoft Project or use the program as a standalone application to produce Pert charts from text files and spreadsheets. The program lets you build time-scaled Pert charts and display task-dependency information directly on the dependency line.
Contact: Jim Spiller & Associates, Austin, TX, (512) 342-2232; http://www.jsaproj.com.
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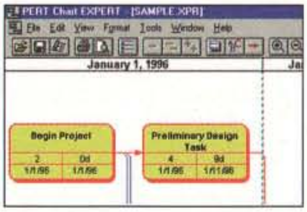

Firewall System

A SYSTEM OF SECURE, INTEROPERATING FIREWALLS for protecting distributed intranets and Internet connections, Telaxian Shield's ($7995 to $11,995, depending on configuration) firewall-to-firewall encryption capabilities allow for virtual private networks within a company site and throughout an extended enterprise, across the Internet and intranets. Logging and auditing features include real-time monitoring, login attempt records, service use logs, and statistical analysis.
Contact: Network Engineering Technologies, San Jose, CA, (408) 453-7500; http://www.fireants.com.
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SMARTMART PROVIDES THE SOFTWARE AND services you need to build, manage, and use a data mart. The product (Entry-Level Edition, from $38,400; Open Database Edition, from $53,300; complete package, from $76,400) for HP/UX, AIX, Sun/Solaris, and Windows NT includes tools for database creation, data

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extraction and transformation, data access and analysis, warehouse management, and an information directory.
Contact: Information Builders, New York, NY, (800) 969-4636 or (212) 736-4433; http://www.ibi.com.
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Communications

Manage Multiple E-Mail Accounts

An Internet e-mail product for Windows 95 and NT, Calypso (single-user version, $79.95) lets you simultaneously access and view multiple e-mail accounts from one mailbox. The program provides e-mail features such as replying, forwarding, attachments, printing, IMAP compatibility, multiple signature support, address groups, blind sending and copying, and encoding support using MIME, BinHex, Base64, and UUencode.
Contact: Micro Computer Systems, Irving, TX, (800) 886-4923 or (214) 659-1624; http://www.mcsdallas.com.
Circle 997 on Inquiry Card.

Engineering

CD-ROM on Finite Element Modeling

The Finite Element Modeling in Engineering Practice CD-ROM ($79) provides engineers with practical methods for testing computer models of parts, products, and processes. Based on the mechanical engineering reference book of the same name, the CD-ROM includes an on-line search function and Internet-style browsers for Windows 95, NT 4.0, and Unix.
Contact: Algor, Pittsburgh, PA, (800) 482-5467 or (412) 967-2700; http://www.algor.com.
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Multimedia

Windows Desktop Video Editing

The Presto! Multimedia Suite ($129) includes Presto! VideoWorks desktop video and audio editing software; Presto! MediaPlayer, a control panel for music CDs, MPEG CDs, Photo CDs, and multimedia files; Presto! ImageFolio image editing software and special effects; Presto! PageManager scanning OS; MetaTools' Kai's Power GOO SE, liquid imaging software to stretch, stir, smear, smudge, and nudge photos; and Presto! MediaClips.
Contact: NewSoft, Fremont, CA, (800) 436-4365 or (510) 252-0267; http://www.tophat.com.
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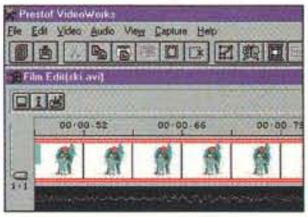

Programming

Create C++ and ActiveX-Based Interfaces

A set of components and class libraries, Ilog Visualization Suite (each product, from $5000 per developer) helps you build interactive, graphical, enterprise-class applications. The suite includes Ilog Inform for building data-intensive graphical applications; Ilog Vision, a graphics library; Ilog MultiViewer, which coordinates multipanel displays and helps you develop real-time graphics that span multiple desktops; and a new release of Ilog Views, a program for building 2-D graphical interfaces for C++ applications.
Contact: Ilog, Mountain View, CA, (800) 367-4564 or (415) 390-9000; http://www.ilog.com.
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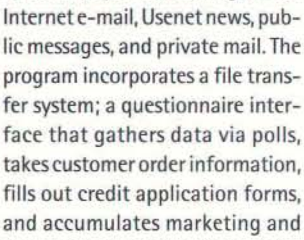
The Web

Create and Maintain Web Sites

A cross between a direct-dial on-line system and an intranet or Web server, Wildcat Interactive Net Server (Community Edition, $99; Business Edition, $1125; Enterprise Edition, $2995) features a message system that enables forum-style conferences that you can configure for Internet e-mail, Usenet news, public messages, and private mail. The program incorporates a file transfer system; a questionnaire interface that gathers data via polls, takes customer order information, fills out credit application forms, and accumulates marketing and demographic information; a teleconferencing/chat system; dynamic HTML; and CGI support.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Promote Your Site

SitePromoter ($129) provides a simple tool to register your site with 150 major search engines, directories, and indices. When you are ready to submit, the program automatically generates the required site data, matching the submitting guidelines for each search engine. You then insert the data onto the search engine. SitePromoter runs in conjunction with Netscape Navigator or Microsoft Internet Explorer and is compatible with Windows 3.1, Win 95, or Macintosh.
Contact: PowerSolutions for Business, St. Louis, MO, (800) 955-3337 or (314) 421-0670; http://www.sitepromoter.com.
Circle 1001 on Inquiry Card.

Open Personal Web Offices

With Netopia Virtual Office ($69.95), Windows-based intranet/Internet users can open a virtual office on the Web. The program provides a place where colleagues can meet and collaborate, leave notes for each other, or drop off or pick up documents and other information. For out-of-the-office communications, Netopia Virtual Office also lets you remotely access your PC to check e-mail, run applications, update your Virtual Office, exchange files, and pick up/drop off messages.
Contact: Farallon Communications, Alameda, CA, (510) 814-5000; http://www.farallon.com.
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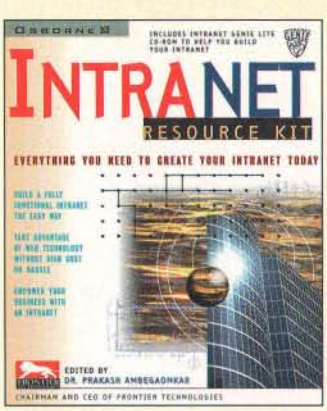
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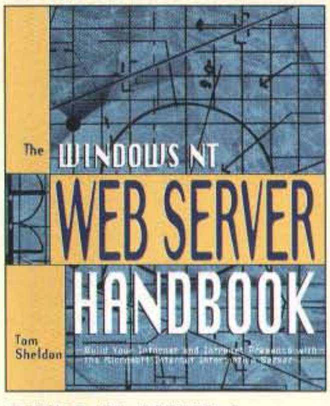

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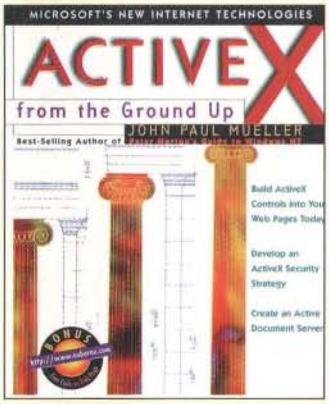

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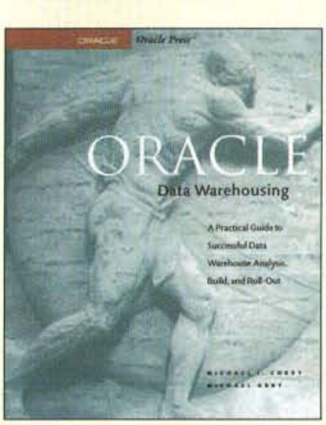

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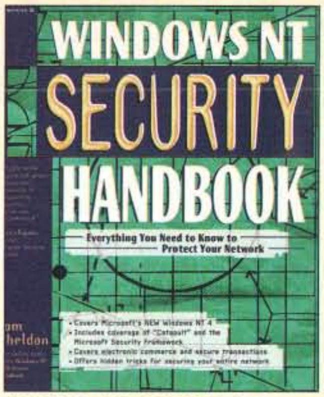

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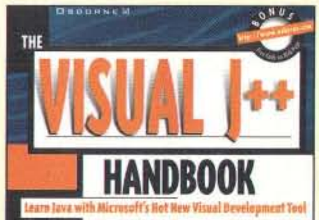

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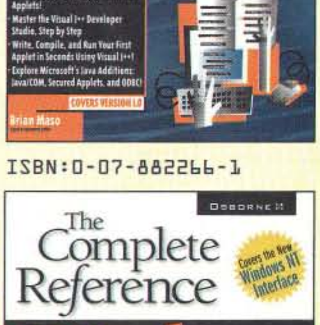
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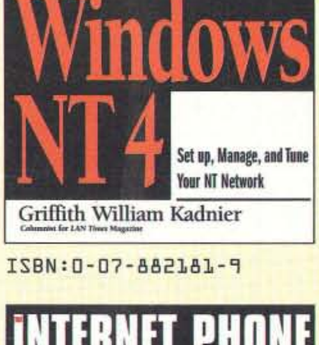
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Windows 95

Scanning Software for 95/NT

With Pagis Pro 97 (about $169), you can capture, use, and organize color documents and incorporate them into Windows Explorer. The program combines PerfectScan, which provides advanced image capture and enhancement, text and picture segmentation, and compound document compression; TextBridge Pro, an OCR program; and Verity's Topic search engine, which gives you tools for locating documents in your system.
Contact: Xerox, Peabody, MA, (888) 997-2447 or (508) 977-2000; http://www.pagis.com.
Circle 1004 on Inquiry Card.

Windows 95 on Silicon Graphics Workstations

With SoftWindows 95 for Silicon Graphics (right-to-use license, about $599), you can run Win 95 applications on your workstation under IRIX 6.2 and 6.3. The program also provides Windows 95 multimedia support, PC networking, PC file sharing capabilities, and support for most PC networks.

Contact: Insignia Solutions, Santa Clara, CA, (800) 848-7677 or (408) 327-6000; http://www.insignia.com.
Circle 1005 on Inquiry Card.

Software Updates

SurveyWin 3.2, the on-line data collection and statistical analysis program for Windows 3.x, 95, NT, and OS/2, offers an unlimited skip feature, which automatically guides users to the next appropriate question; hyperlinks; bit-map support; and visible or invisible calculated fields. $495.
Contact: RaoSoft, Seattle, WA, (206) 525-4025; http://www.raosoft.com/raosoft/.
Circle 1006 on Inquiry Card.

Implementing Netscape's LiveConnect framework, **WebXpresso 1.2**, the Web-enabling component of DataViews' DV-Xpresso modular development tool, lets you create applications that access transparently both client and server Web-based applications. In addition, version 1.2 supports Java native methods for getting and setting object attributes and input and select callbacks. For Windows 95, NT, and Unix, from $1000.
Contact: DataViews, Northampton, MA, (800) 732-3200 or (413) 586-4144; http://www.dvcorp.com.
Circle 1007 on Inquiry Card.

RemoteWare 3.1 for Windows NT adds messaging support, MAPI support, subscription and publishing services, and accessibility from within a Web browser. Server license, from $5000; basic clients, $200; extended clients, $375.
Contact: XcelleNet, Atlanta, GA, (800) 322-3366 or (770) 804-8100; http://www.xcellenet.com.
Circle 1008 on Inquiry Card.

HARDWARE

Accessories

Stereo PC Headset

The ANC-550 Stereo PC Headset ($79.95) features active noise-cancellation technology. This creates a 180-degree out-of-phase antinoise signal that cancels background noise and echo speaker feedback, while increasing the speed and accuracy of voice-computing applications. The ANC-550 comes with a microphone on/off mute switch, a lapel clip, and a converter plug. Andrea Electronics also offers the Multimedia Audio Controller MC-100 ($34.95), which lets you easily switch between your PC headset and multimedia speaker system with the flick of a switch.
Contact: Andrea Electronics, Long Island City, NY, (800) 442-7787 or (718) 729-8500; http://www.andreaelectronics.com.
Circle 1012 on Inquiry Card.

Headset Telephone

The lightweight, adjustable HT530 headset ($59.95) comes with a single-headphone-style ear piece and flex-mounted microphone. You can use the headset to answer calls and to place outbound calls with PCs (equipped with the appropriate software) from companies such as Acer, Apple, AST, Packard Bell, Compaq, NEC, IBM, Hewlett-Packard, and Sony. The included Y connector lets you use the headset with a standard telephone. The HT560 ($99.95) combines the HT530 headset and a compact telephone with features such as adjustable volume, one-touch call hold, last-number redial, and a flash button for use with call waiting.

Contact: Command Communications, Aurora, CO, (800) 288-6794 or (303) 751-7000; 76735.3714@compuserve.com.
Circle 1011 on Inquiry Card.

Add-Ins

686 Embedded CPU Board

Operating at speeds of up to 200 MHz, the IPH-686 Half Size ISA Pentium board (from $875) supports 256-KB through 1-MB pipeline burst and standard cache RAM modules for high-speed access to blocks of data. The board comes with two 16C550-compatible serial ports, a bidirectional ECP/EPP, a dual floppy drive port, two EIDE hard drive ports, a PS/2 keyboard port, a PS/2 mouse port, an on-board speaker, a WatchDog timer, and up to 64 MB of DRAM.
Contact: Micro Computer Specialists, Vista, CA, (800) 347-6274 or (619) 598-2177; http://www.industry.net/mcsi.
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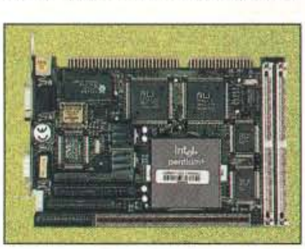

Video Engine for PCs

You can use the VideoX2 (from $1795) as the foundation for a PC-based video-mixing system. The board comes with a two-channel digital video mixer; an input for an MPEG/JPEG card; composite and S-Video in/out; a two-channel TBC/synchronizer; more than 250 special effects transitions; antialiased fonts and graphics; two-channel freeze-frame; and a four-channel stereo audio mixer.
Contact: TV One, Erlanger, KY, (800) 721-4044 or (606) 282-7303; http://www.tvone.com.
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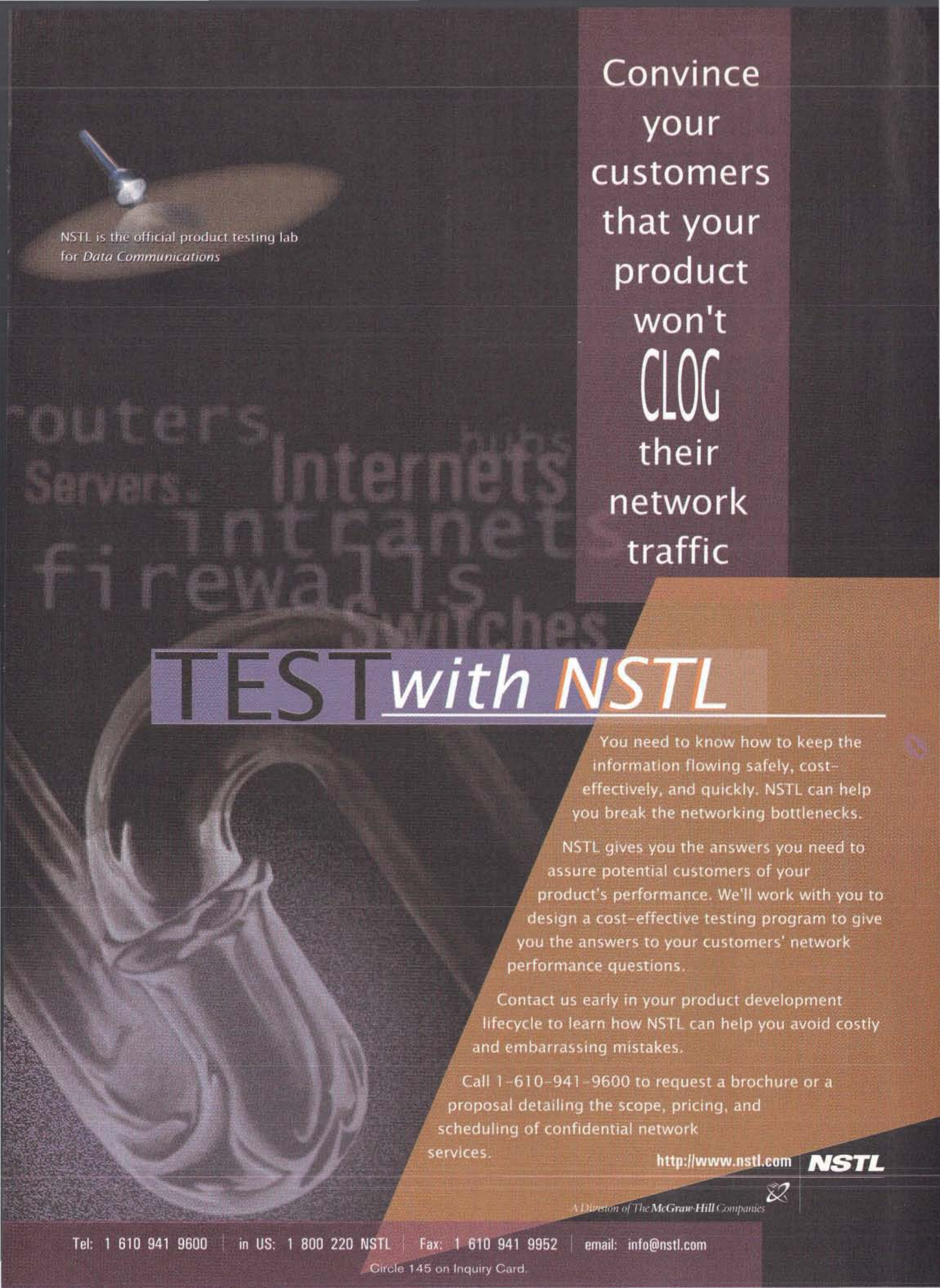

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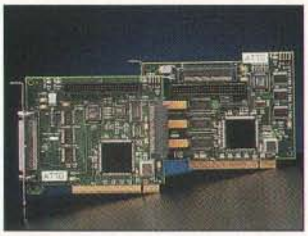
Ultra-Wide SCSI-3 Macintosh Accelerator

Designed to maximize I/O transfer speed and boost total system performance for digital video, prepress, server, and real-time applications, the ExpressPCI-Pro Series ($395) delivers transfer rates of up to 40 MBps. Atto's new line of host adapters features full block buffering, embedded 80-MHz RISC SCSI-3 processor, improved data interleave architecture, and PCI 2.1 compliance.



Contact: Atto Technology, Amherst, NY, (716) 691-1999; http://www.attotech.com.
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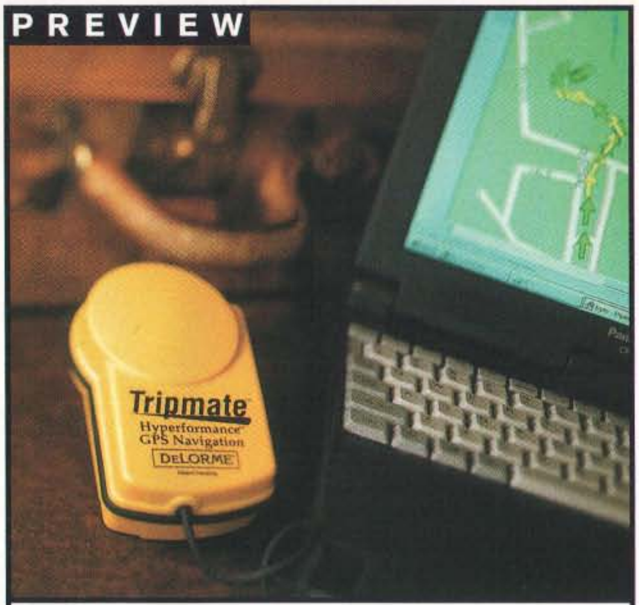

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Help for Lost Souls Everywhere

DeLorme's Tripmate is a 9-ounce device that's slightly larger than a bar of soap and uses Global Positioning System (GPS) satellites to fix your location. You can use the unit with a notebook PC running Win 95 and DeLorme's Street Atlas USA 4.0 or AAA Map'n'Go. The Tripmate, which runs on four AA batteries or an optional power adapter kit, easily connects to the notebook's serial port. I used the new CF-62 notebook from Panasonic (800-662-3537). It includes a 12.1-inch active matrix screen and an internal drive that plays both CD-ROM and rewritable phase-change discs. Tripmate installed easily on the Panasonic system, and once I properly configured the time and date of the Street Atlas software, I was tracking my progress in real time as I drove across state.

Tripmate's 12-channel receiver was quite accurate, though the accuracy can drift beyond 100 meters or so if the device can't get a clear view of the sky to get a proper location fix; tall buildings or thick foliage can interfere with positioning. And I would have liked the Tripmate to have battery status lights. But those minor quibbles aside, the Tripmate's easy installation and low price make this a must-have in the "cool device" category. Plus, it will get you to that meeting on time without you having to stop and ask directions.

–Dave Andrews

Communications

Computerized Whiteboard

With Ibid (about $499), users in multiple locations can create, capture, collaborate, and communicate information. The 38- by 31-inch, 18-pound product combines the visual communication capabilities of whiteboards with the storage, access, and digital communications benefits of PCs. Ibid can capture the results of interactive sessions, including multicolor drawings and text, save the information in PC memory, and incorporate it into most Windows-based applications.
Contact: The MicroTouch Business Products Division, Tewksbury, MA, (800) 642-7686 or (508) 659-9000; http://www.microtouch.com.
Circle 1016 on Inquiry Card.

Real-Time Videoconferencing

A hardware and software kit, SEE-Quest transforms your Windows PC into a desktop videoconferencing workstation. The kit consists of Shark Multimedia's Baby Tiger 33.6-Kbps DSVD modem, the Connectix Color or Black and White QuickCam video camera, the Connectix VideoPhone, a microphone, and a suite of audio and video software (black and white, $369; color, $479). The Baby Tiger DSVD modem transmits and receives full-duplex audio and video data simultaneously over a standard telephone line. The modem operates at speeds of up to 33.6 Kbps and combines V.34 modulation with MNP 2-4 and V.42 LAPM error correction for throughput of up to 115.2 Kbps.
Contact: Shark Multimedia, Santa Clara, CA, (800) 800-3321 or (408) 987-5400; http://www.sharkmm.com.
Circle 1017 on Inquiry Card.

Networking

Wireless LAN PC Card Adapter and Access Points

At 1.6 Mbps, the RangeLAN2 7400 PC Card ($695) provides high-speed data transfer and interchangeable antennae, so you can select the antenna that matches your specific device and coverage needs. The RangeLAN2 AP-II 7510 and 7520 Access Points (from $1895) come with a MIPS R3000 RISC processor; throughput optimization; remote configuration over a modem; built-in site survey; Telnet support over Ethernet, serial, and wireless; and SNMP support in the RangeLAN2 7520 Access Point.

Contact: Proxim, Mountain View, CA, (800) 229-1630 or (415) 960-1630; http://www.proxim.com.
Circle 1018 on Inquiry Card.

Peripherals

Four Desktop Scanners

The four models in the Copiscan 8000 Series of scanners (from $22,000) range in speed from 60 to more than 100 pages per minute in portrait mode. Each comes with 13 resolutions between 100 and 400 dpi, a 500-sheet automatic/manual

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Complete details are available from our e-mail auto-responder at info@bix.com or by visiting the BIX Web Site (see below).

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Contact: Bell & Howell, Arlington Heights, IL, (800) 722-6494 or (847) 357-0630; http://www.bellhowell.com.
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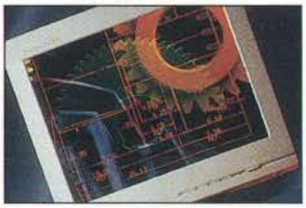
Wide-Screen Color Monitor

The PanaSync/Pro P21 monitor ($2099) has a 20-inch viewable image size and features a refresh rate of 71 Hz, a resolution of 1800 by 1440, and a dot pitch of 0.25 mm. The monitor has an antiglare, antireflection, and antistatic screen; eight preset timing modes and 13 user memory modes; and frequency ranges of 30 kHz to 115 kHz horizontal and 50 Hz to 160 Hz vertical.



Contact: Panasonic Communications & Systems, Secaucus, NJ, (800) 726-2797 or (201) 348-7000; http://www.panasonic.com.
Circle 1021 on Inquiry Card.

Ultra SCSI Hard Drives

The Tomahawk 9 Model 3391 ($2900) provides 9.10 GB of formatted capacity in a 3.5-inch form factor. The low-profile Tomahawk 4LP Model 4345 ($1630) offers 4.55 GB of formatted capacity. Both Micropolis drives feature magneto-resistive heads, 7.9-ms average seek times, 7200-rpm rotational speeds, a SCSI-2/-3 command set, a 297-bit ECC with on-the-fly error correction, a 512-KB multisegmented cache, tagged command queuing with seek and latency optimization, and zero-latency read/write operations.
Contact: Micropolis, Chatsworth, CA, (818) 709-2730; http://www.micropolis.com.
Circle 1020 on Inquiry Card.

External Tape Drives

The TapeStor 800 ($149) can store up to 800 MB of compressed data or up to 400 MB of uncompressed data on a Travan TR1 cartridge. The TapeStor 3200 ($249) can handle up to 3.2 GB of compressed data or up to 1.6 GB of uncompressed data per cartridge.

Contact: Seagate Technology, Costa Mesa, CA, (800) 626-6637 or (714) 641-1230; http://www.seagate.com.
Circle 1022 on Inquiry Card.

Servers

Petabyte Server

A specialized data-access server, the FastfilePro-HA is capable of handling up to 1 petabyte, or 1024 terabytes, of data in the form of 128 disk volumes, each configured with 8 TB of storage. You can configure your server to work with levels 0, 1, 0+1, RAID 3 equivalent, 5, and JBOD. The server offers a journaling automation system, the AerREAL operating system, and an HTTP module, adding read-only access to Web files.

Contact: Falcon Systems, Sacramento, CA, (800) 326-1002 or (916) 641-7200; http://www.falcons.com.
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Systems

SPARC-Compatible Graphics Workstations

Designed to deliver high-performance Creator graphics capabilities, including 3-D triangles, vectors, and quads, to a range of applications, the COMPstation U200-ES comes with a 200-MHz 64-bit UltraSparc 1 processor, 1 MB of external cache, and a data transfer rate of up to 1.6 GB per second. A standard configuration (from $17,530) includes 64 MB of RAM, a 2-GB hard drive, a 20-inch color monitor, a 128-bit UPA slot, three SBus slots, two serial ports, one parallel port, a 10Base-T Ethernet interface, Fast SCSI-2, and CD-quality 16-bit audio capabilities.

Contact: Tatung Science & Technology, Milpitas, CA, (800) 659-5902 or (408) 383-0988; http://www.tsti.com.
Circle 1026 on Inquiry Card.

Easily Upgradable Pentium Notebooks

The architecture of the OpenNote Pentium notebook PCs provides an easy upgrade path for all system components and peripherals. The OpenNote Model 680C ($2795) comes with a PCI-based 120-MHz Pentium CPU; 16 MB of memory, expandable to 64 MB; and an 11.3-inch DSTN SVGA display. The OpenNote Model 680TX ($3395) comes with a PCI-based 133-MHz Pentium processor; 32 MB of RAM, expandable to 64 MB; and an 11.3-inch TFT SVGA display. Both models also feature a removable 1.1-GB hard drive; a 3.5-inch removable floppy drive; a 6x internal CD-ROM drive; a Sound Blaster Pro 16 sound card with built-in speakers; MPEG support; two Type II (or one Type III) PC Card slots; a touchpad pointing device; and a dual NiMH detachable/rechargeable battery supply.

Contact: Kiwi Computer, Santa Clara, CA, (888) 688-5494 or (408) 492-9188; http://www.kiwicom.com.
Circle 1024 on Inquiry Card.

SPARC Notebook

Incorporating a 170-MHz TurboSparc processor, the PowerLite Turbo 170 comes with up to 256 MB of memory, 512 KB of secondary cache, a 12.1-inch 1024 by 768 or 800 by 600 display, up to 3.6 GB of hard drive storage, a TGX graphics accelerator, a fax/modem card, and a 16-mm trackball in a 7.5-pound notebook-size package. The system is available with SunSoft's Solaris 2.5 or Solaris 1.1.2 operating systems and is compatible with Sun workstations.
Contact: RDI Computer, Carlsbad, CA, (800) 734-5483 or (619) 929-0992; http://www.rdi.com.
Circle 1025 on Inquiry Card.

Java's RAD Route to Data Access

Visual Café Pro lets you develop distributed data access applications using Java.

By Rick Grehan

With its Visual Café Pro (VCP) package, Symantec brings rapid application development for Java into areas often associated with traditional client/server development. The professional version of Visual Café adds wizards (software assistants) and database middleware technology to help developers create Java programs that access information from databases on the back end. This data is then presented to the end user in any Java-compliant Web browser.

VCP consists of Visual Café and the dbAnywhere middleware, lashed together by a set of wizards. The program illustrates an emerging breed of development tools that let users leverage the Web to access data stored in a wide variety of databases. VCP represents a logical progression for Symantec's Café, which I used when I converted the BYTE benchmarks from C to Java. (Back then, Café wasn't a visual development environment, but it was a solid Java development system whose integrated debugger was a blessed relief from the command-line debugger that's included in the Sun Java Development Kit.)

Symantec has constructed upon this foundation the kind of form-based application-building environment that's becoming the mainstay of Windows development. When you start a new project, VCP lets you select from among three templates: a completely empty project, a basic application, or a basic applet. The first template is an empty workspace that's a throwback to life before Café went visual. The latter two templates jump-start your application with empty forms ready for filling with buttons and text fields and such. In fact, the application template prebuilds "about" and "quit" dialog boxes.

Visual Café comes with a basic set of predefined components. You'll find buttons, scroll bars, and text fields, as well as a collection of dialog boxes. When you click and drag a component from the tool palette, VCP pours the necessary Java source code into your project to instantiate the component.

New in the Visual Café environment is its interaction wizard, which is a button to the left of the component speedbar. The interaction wizard lets you mouse-click your way through the process of associating an action to a component-received event. For example, you could use the interaction wizard to connect a mouse-click event on an "about" button to the opening of an "about" dialog box; Visual Café Pro will then write the code for you.

The database middleware component is supplied by dbAnywhere, which supports the Sun/JavaSoft Java Database Connectivity (JDBC) API; dbAnywhere is able to handle a variety of back-end databases, ranging from lowly dBase II all the way up to Oracle Server, either through direct drivers or ODBC drivers. Applets that are created by the Café side of Visual Café Pro communicate with a dbAnywhere server, thus providing what is formally a three-tier architecture: Applet as the GUI, dbAnywhere in the middle, and database drivers on the back end. Notice what this means: A client can download an applet from an Internet server on one machine, but that applet can connect to a dbAnywhere server running on a completely different machine on the Internet, anywhere in the world.

PRODUCT INFORMATION

Visual Café Pro
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Practically speaking, though, at this stage dbAnywhere functions as merely a connection and translation service by connecting the applet to the database and translating between the database driver and the JDBC API. I suspect that Symantec has another edition of Visual Café in the works, perhaps an enterprise version, that will allow developers to extend dbAnywhere, adding business logic programming into the middle tier.

Doing programming with Java components is not a pretty thing. Because Java has no notion of a resource file (at least not yet, anyway), every detail of a component—for example, a button's size, color, or font—must be hardwired into the source code. Also, programming to JDBC amounts to working with SQL, which has never been pretty. Visual Café Pro, therefore, handles a great deal of ugliness for you. Symantec's RAD kit is no Delphi for the Internet yet—but it's pretty close.

Rick Grehan is a senior technical editor for BYTE reviews and the coauthor of The Client/Server Toolkit for C/C++ Programmers *(NobleNet, 1996). You can reach him at* **rick_g@bix.com.**

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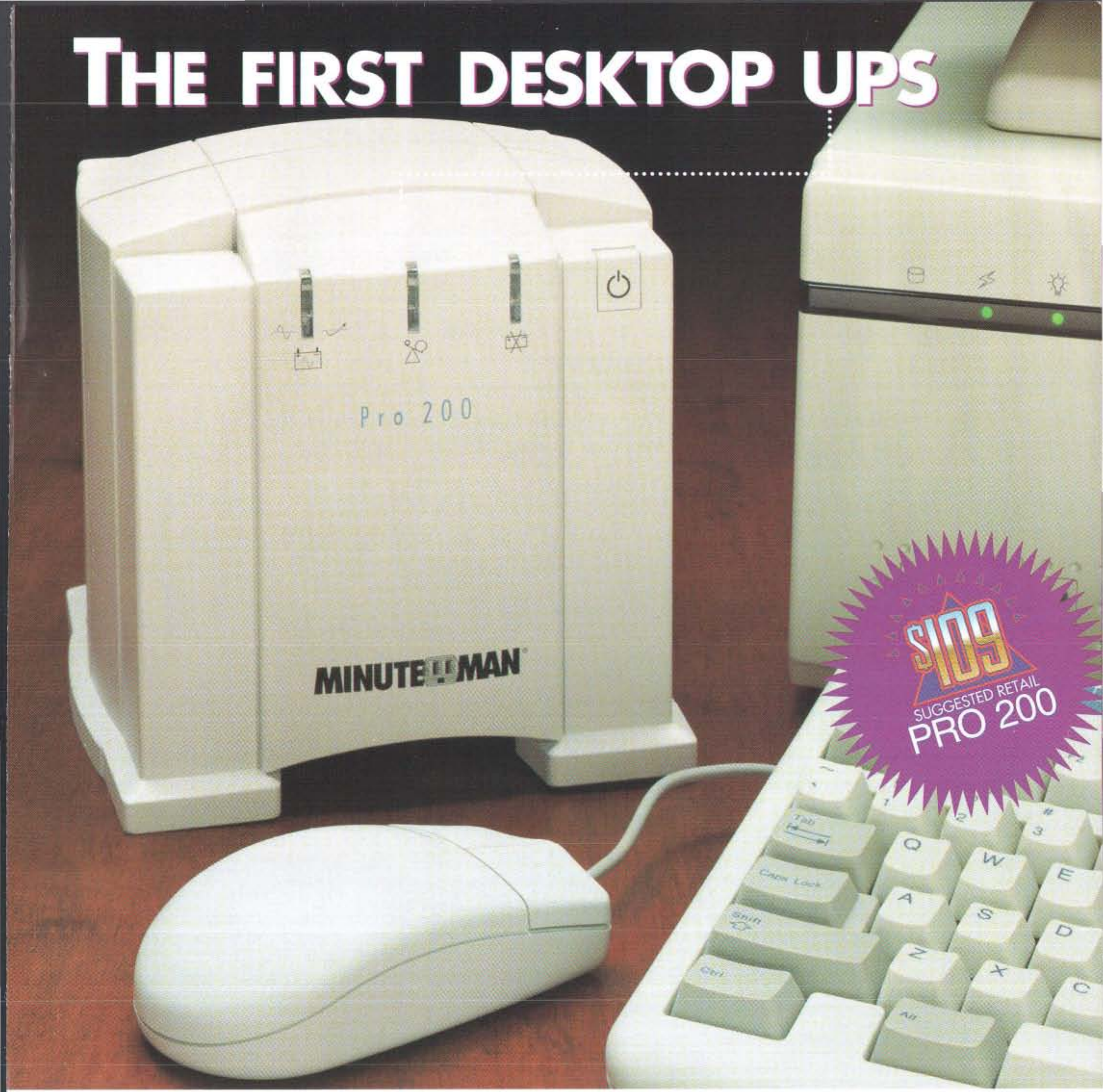

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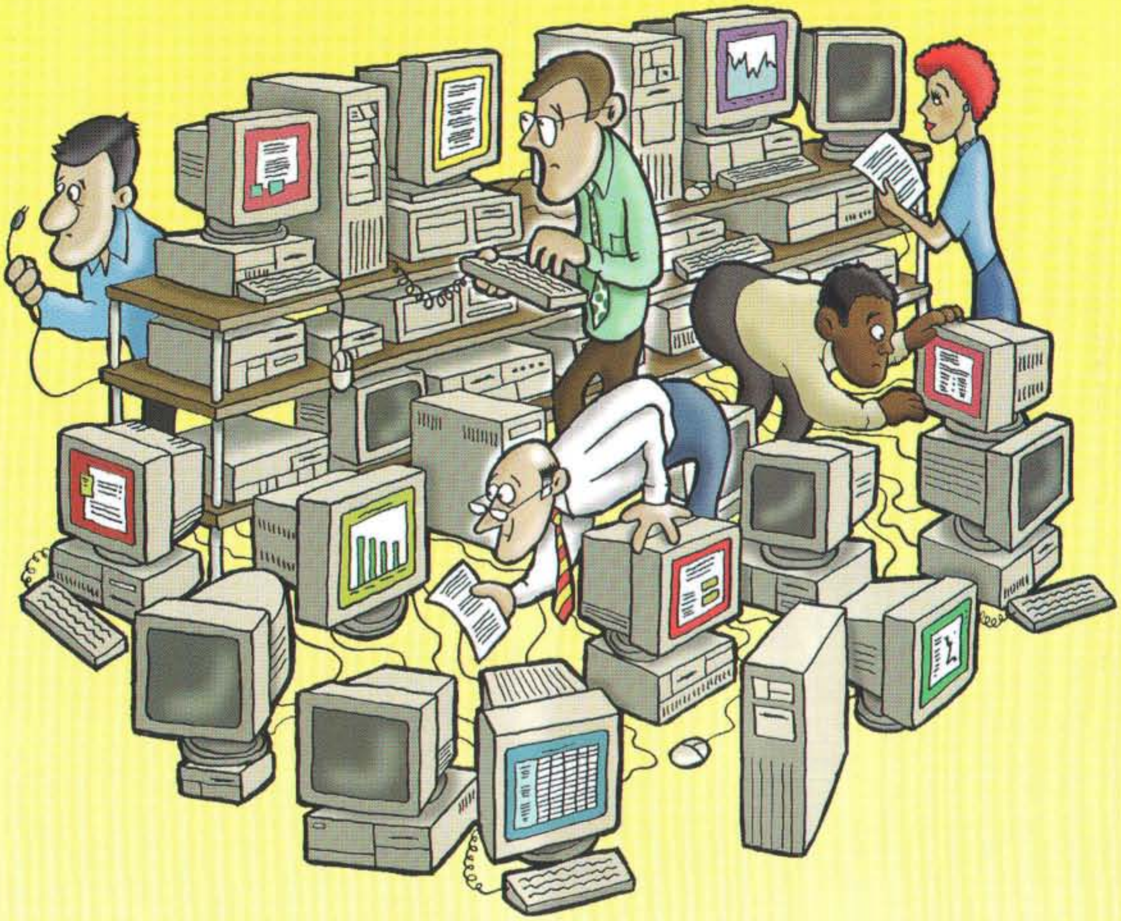

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